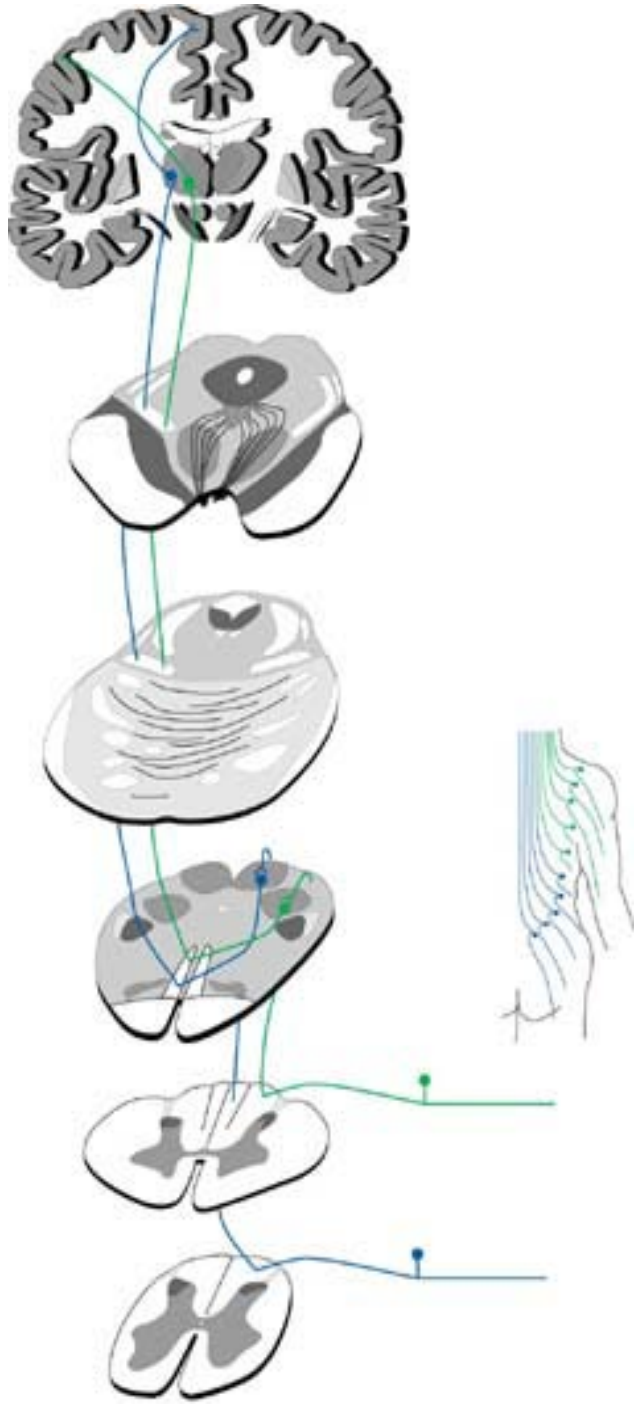
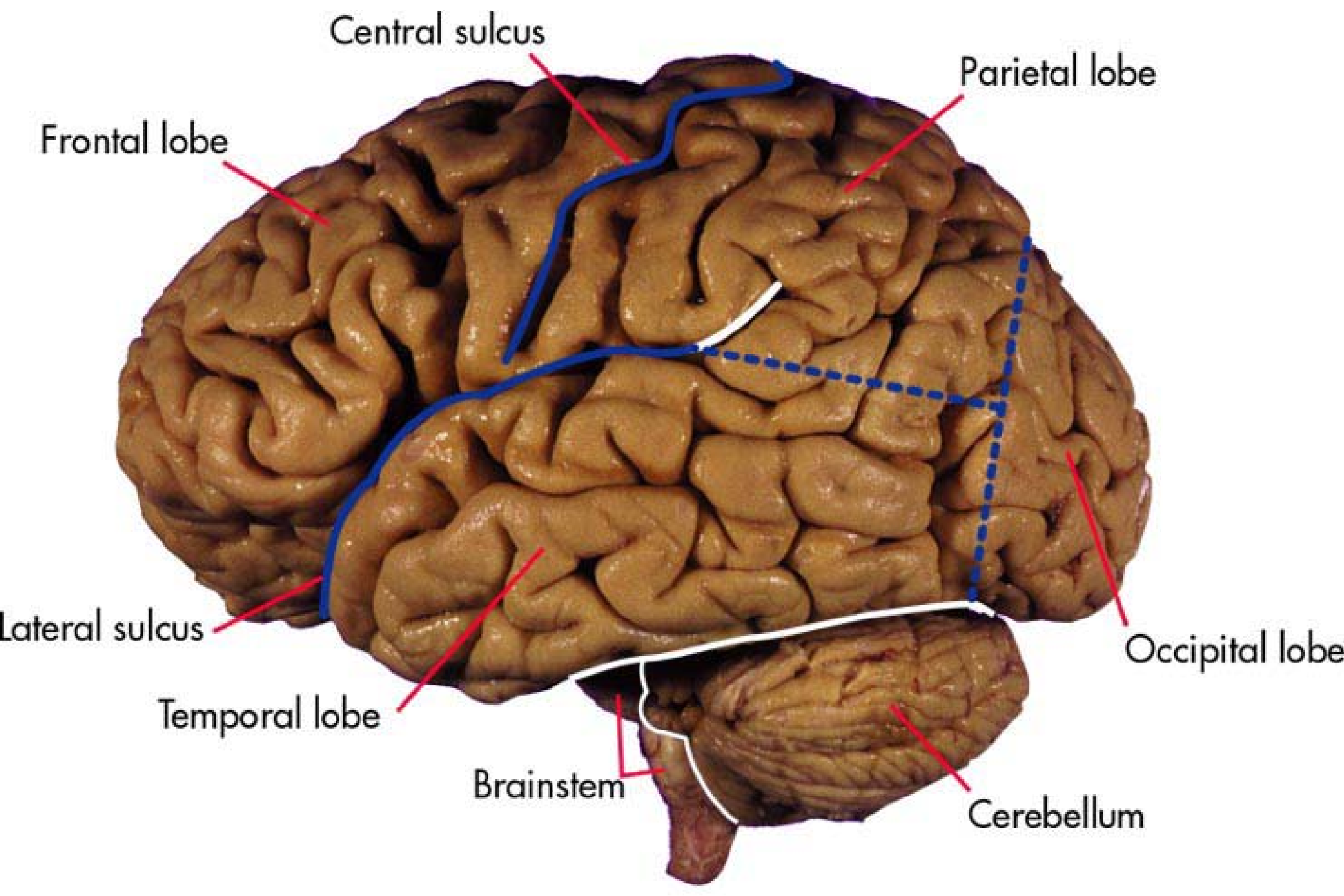
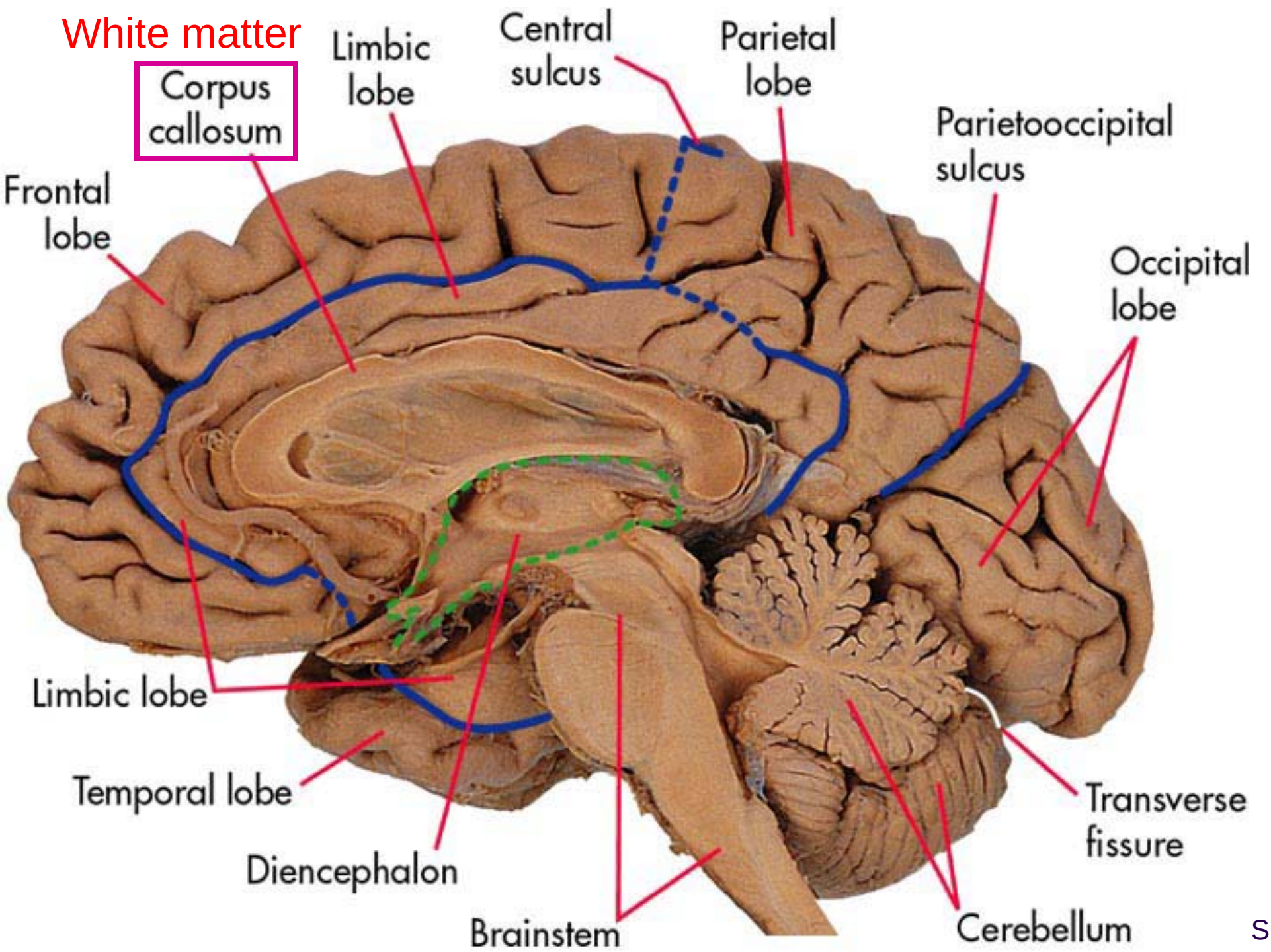


Overview:

1. **Central Nervous System (CNS)**
2. **Meninges**
3. **Cerebrospinal fluid (CSF)**
4. **Autonomic Nervous System (ANS)**

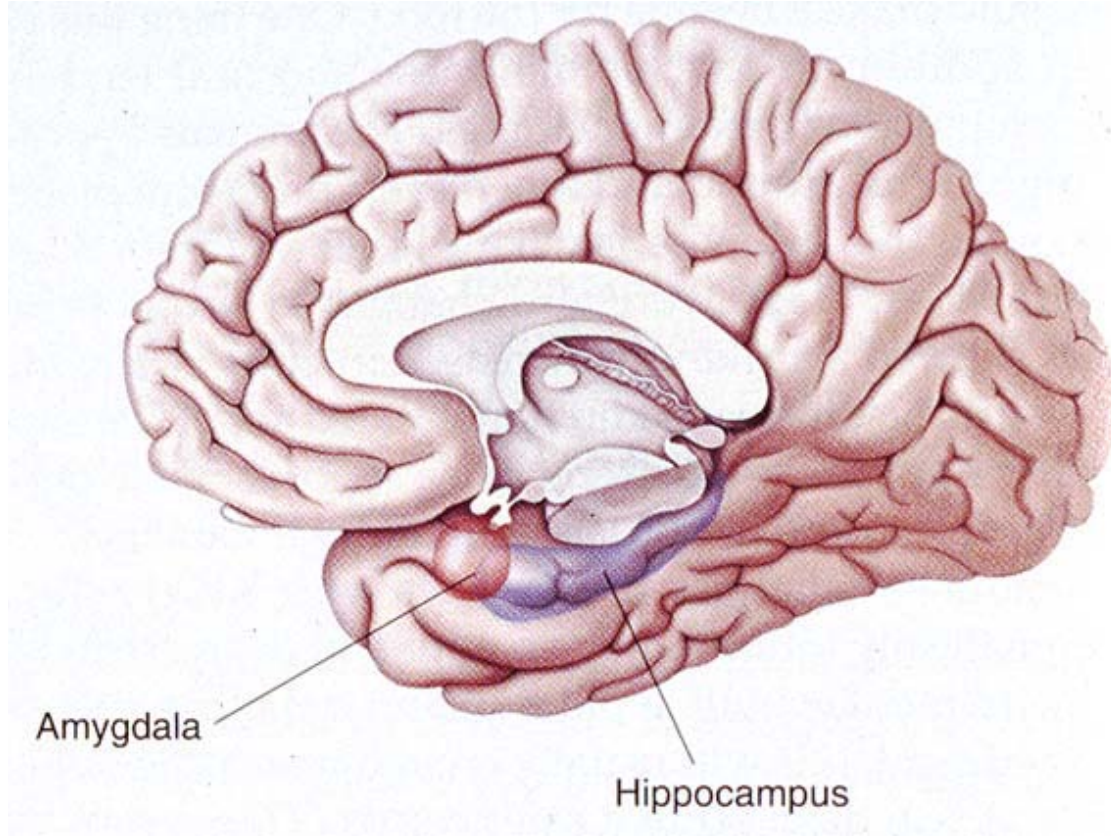
- 3D mental images
- Correlations with functions and disease pathology: neurodegeneration (Alzheimer's disease etc)


Central sulcus
Parietal lobe
Frontal lobe
Lateral sulcus
Occipital lobe
Temporal lobe
Brainstem
Cerebellum

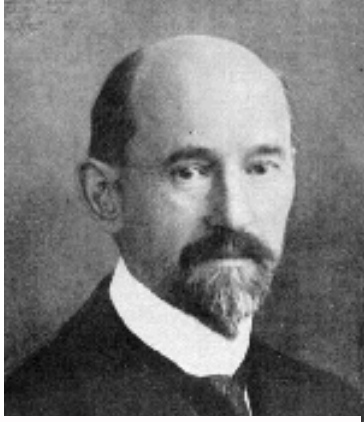

White matter
Corpus callosum
Limbic lobe
Central sulcus
Parietal lobe
Parietooccipital sulcus
Frontal lobe
Occipital lobe
Limbic lobe
Temporal lobe
Diencephalon
Brainstem
Cerebellum
Transverse fissure

Medial surface of temporal lobe (mesial temproal lobe): major parts of Limbic system

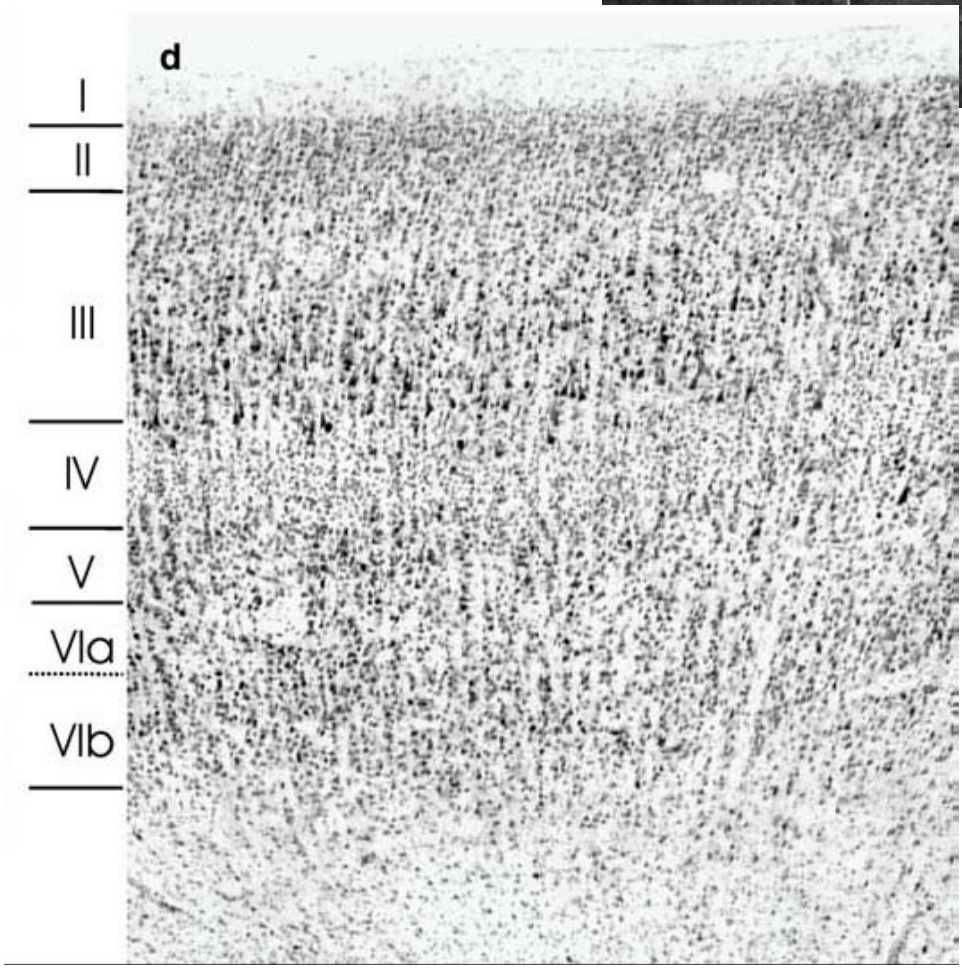
- Hippocampus: memory
- Amygdala: emotions
- parts of Limbic system

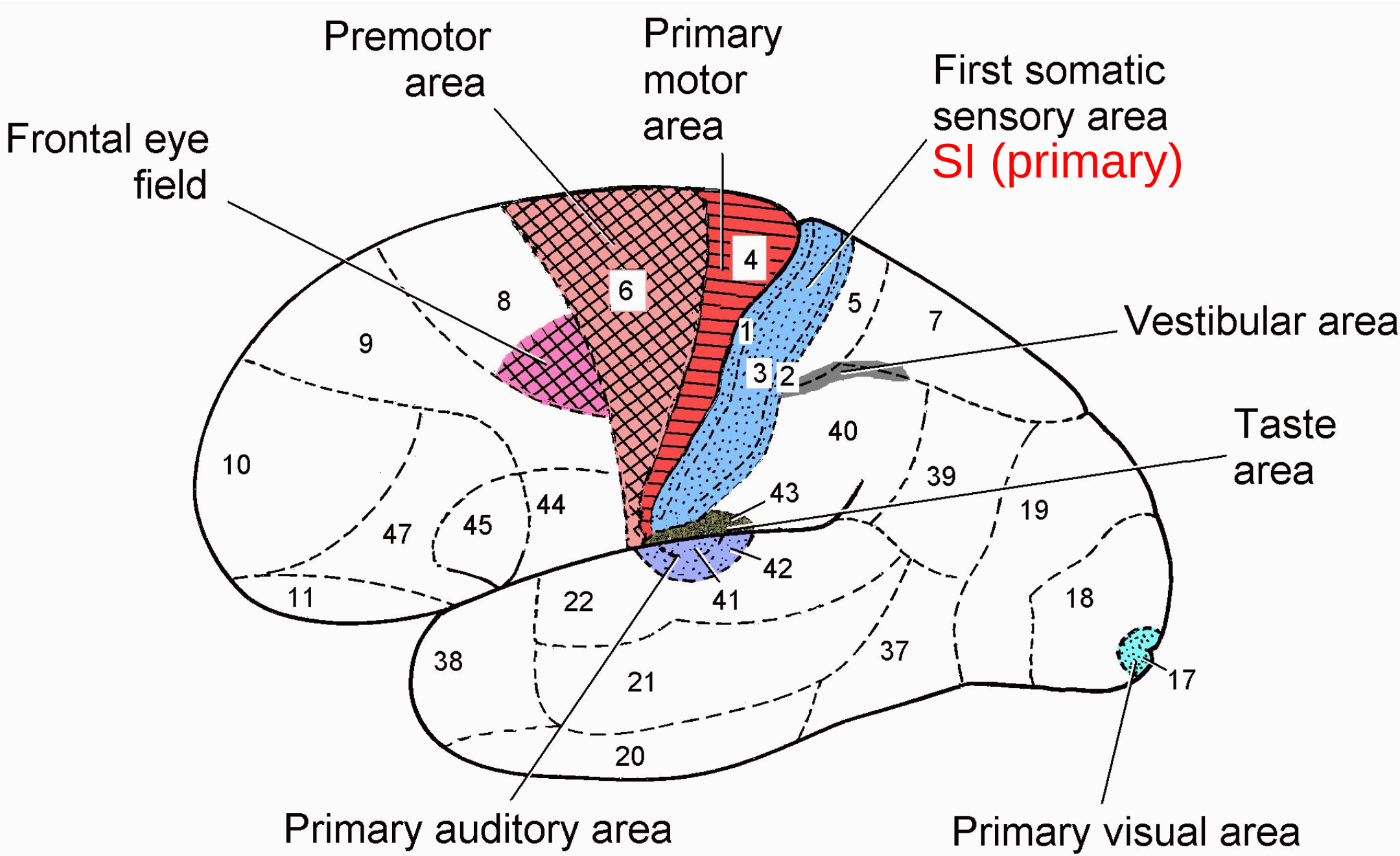


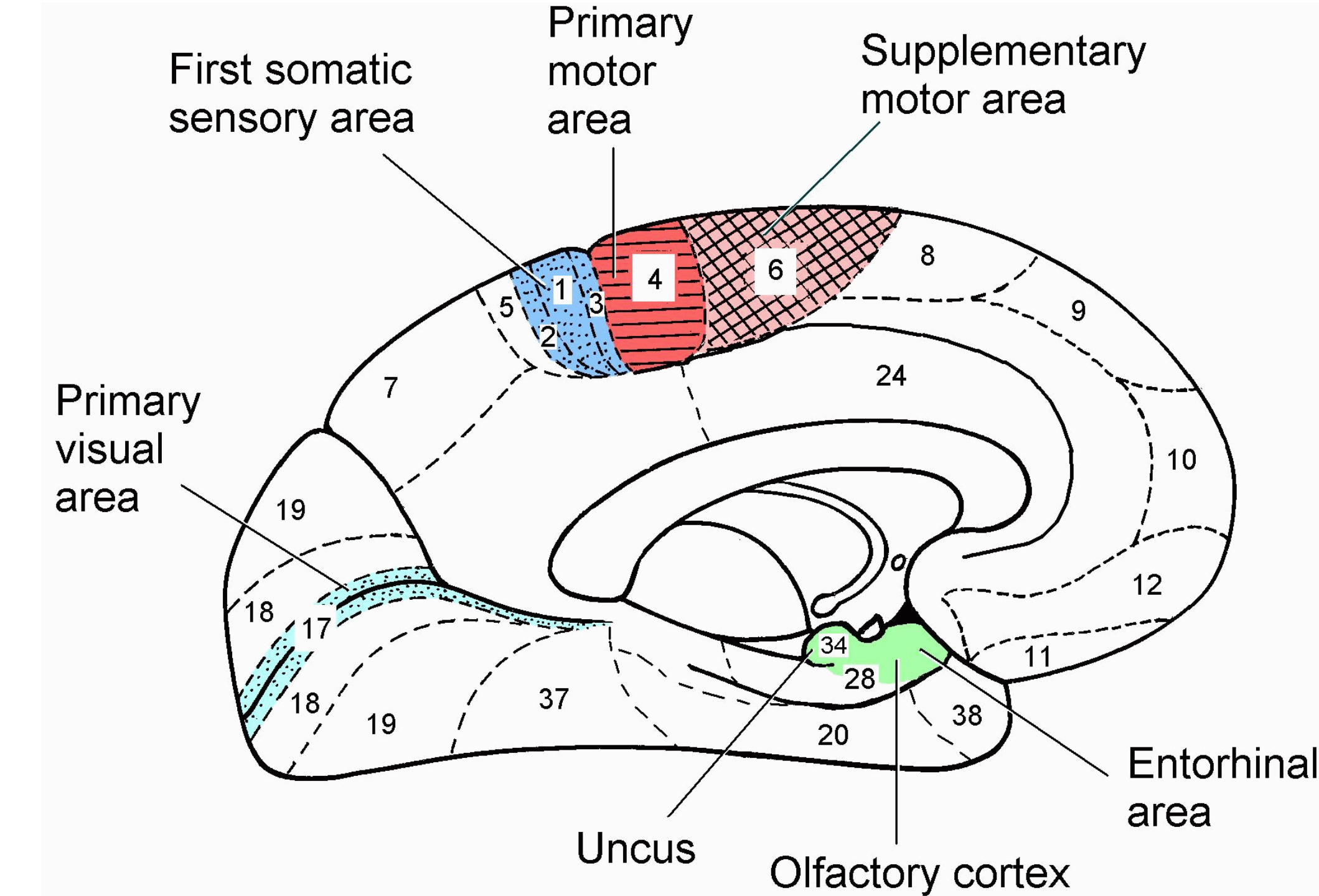
Brodmann's area: cytoarchitetonic features



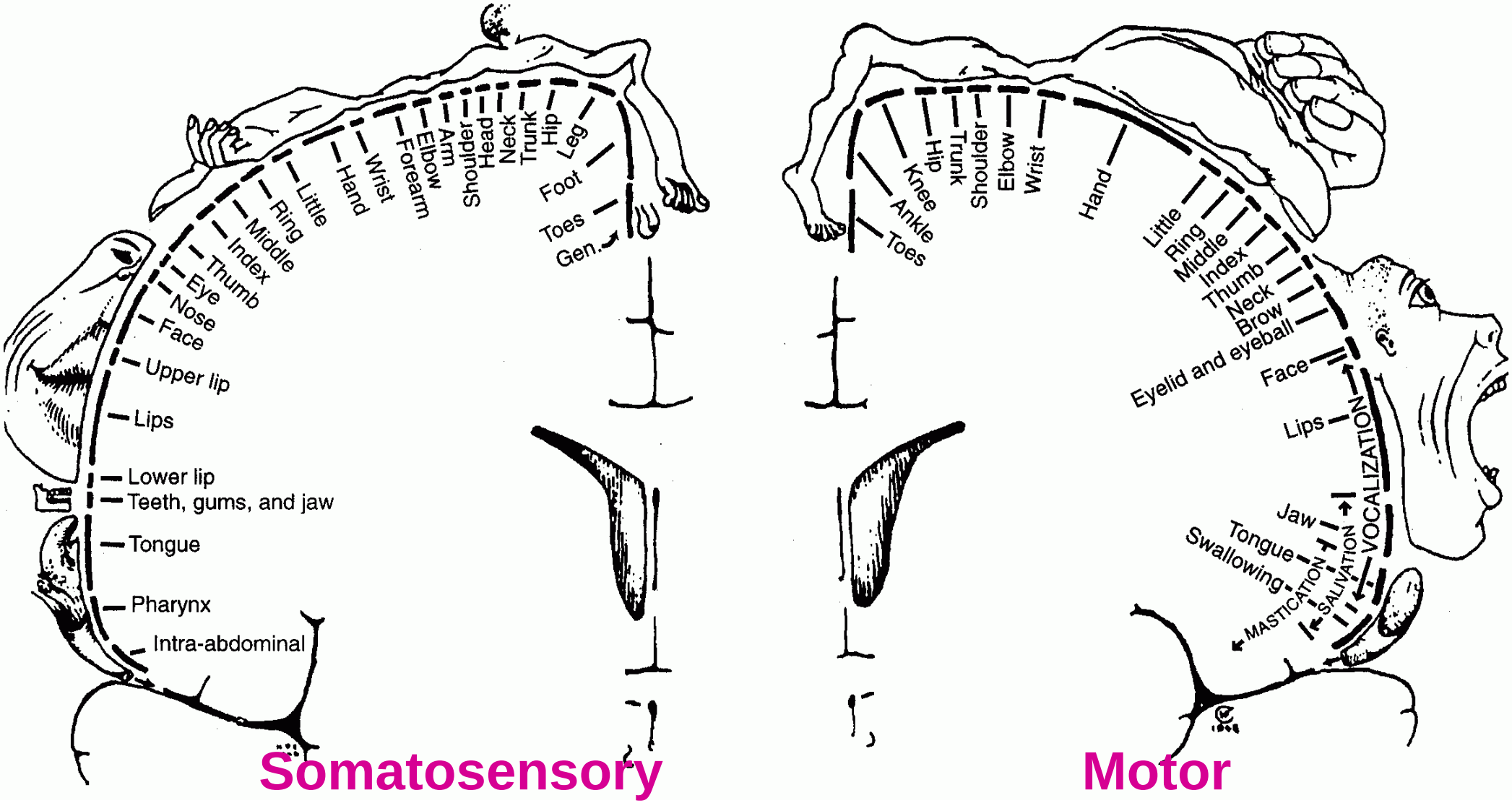
- Frontal lobe
  - Primary motor area (4)
  - Supplementary motor area/Premotor area (6)
  - Frontal eye area (8)
- Parietal lobe
  - Primary somatosensory area (3,2,1)
- Temporal lobe
  - Primary auditory area (41,42)
- Occipital lobe
  - Primary visual area (17)




Premotor area
Primary motor area
First somatic sensory area
SI (primary)
Frontal eye field
Vestibular area
Taste area
Primary auditory area
Primary visual area
4
6
8
5
7
1
3
2
9
40
10
39
43
44
19
47
45
42
41
11
22
18
38
37
21
17
20

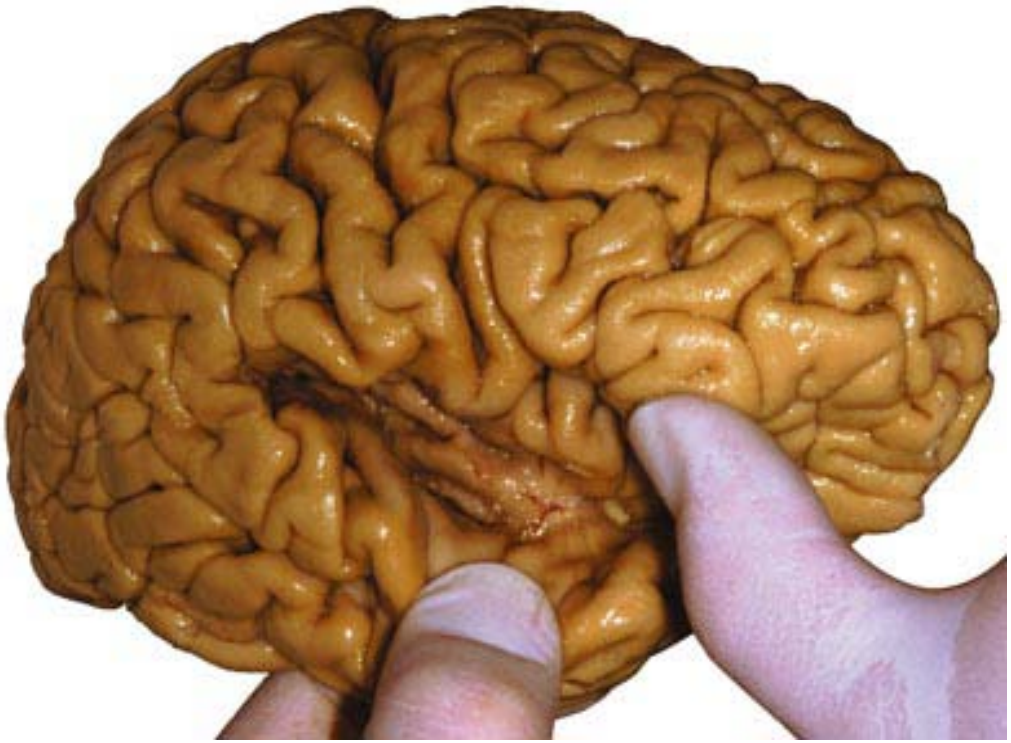

First somatic sensory area
Primary motor area
Supplementary motor area
Primary visual area
Uncus
Olfactory cortex
Entorhinal area
1
2
3
4
5
6
7
8
9
10
11
12
17
18
19
20
24
28
34
37
38

Somatotopic Organization: corresponding brain areas and body parts



Insula, Opercullum

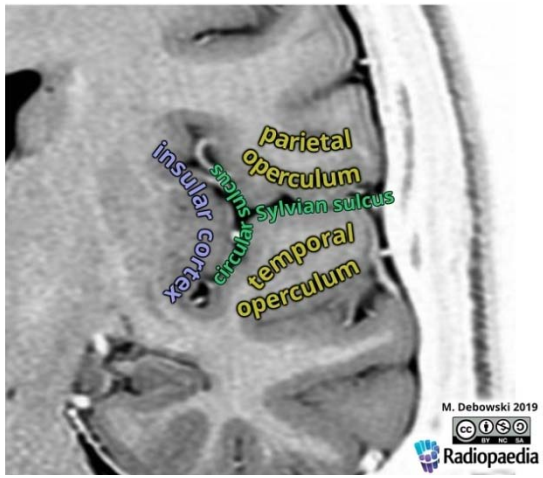
- Insula: buried underneath lateral sulcus
- Operculum (“lid”); covering insula
- Circular sulcus: outlining insula



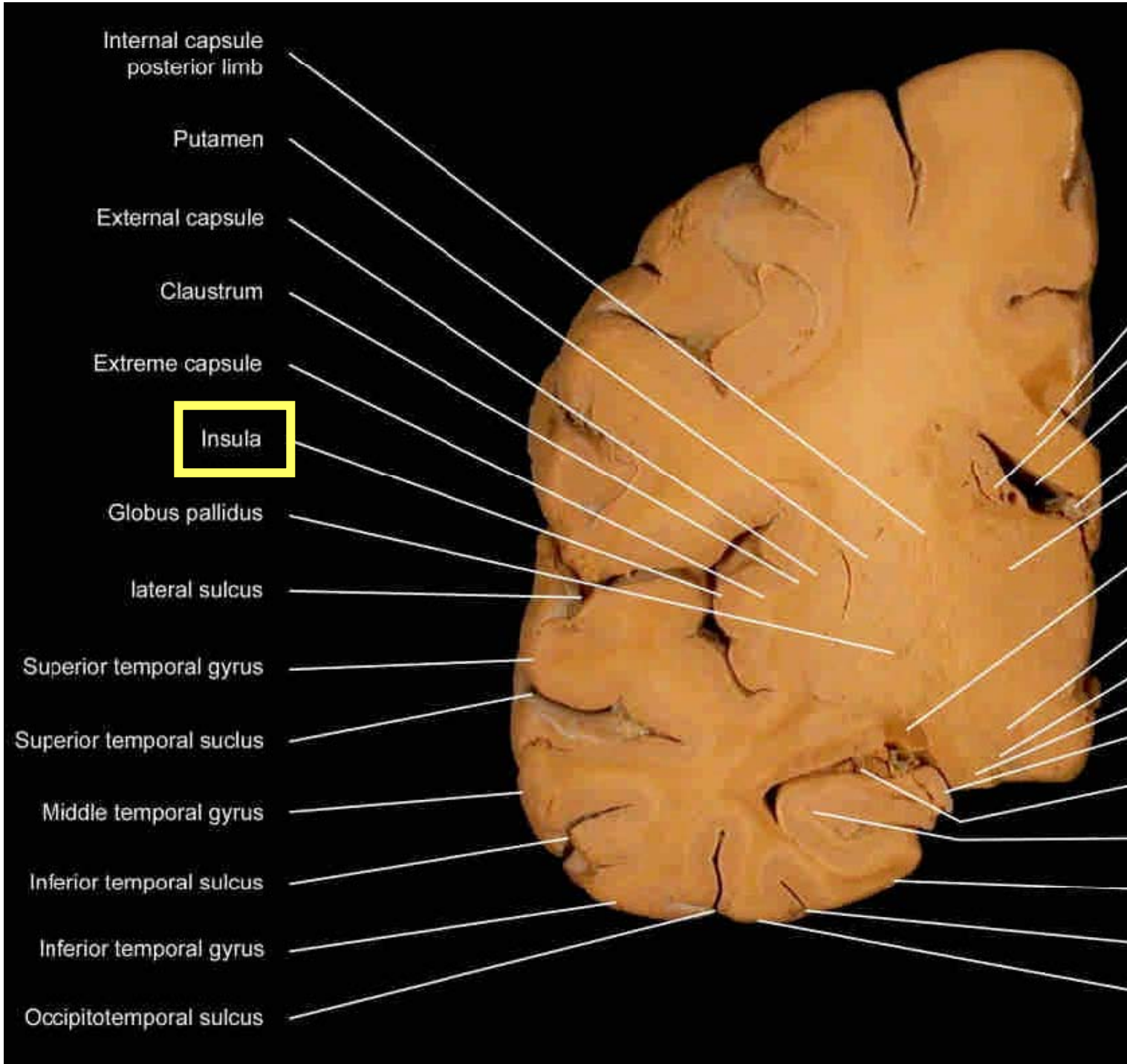
Insula

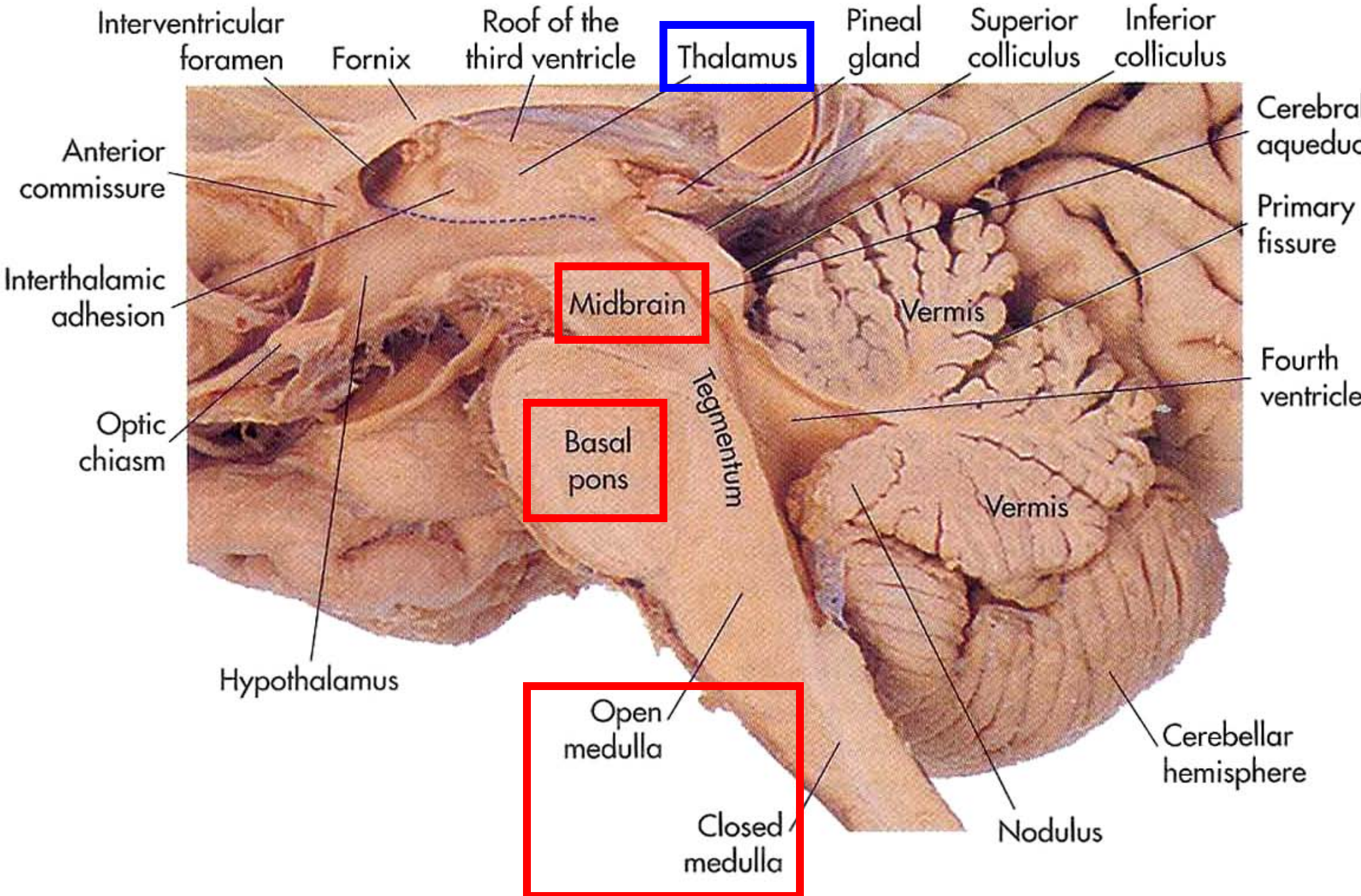
- Operculum (frontal, parietal, temporal)
- Circular sulcus

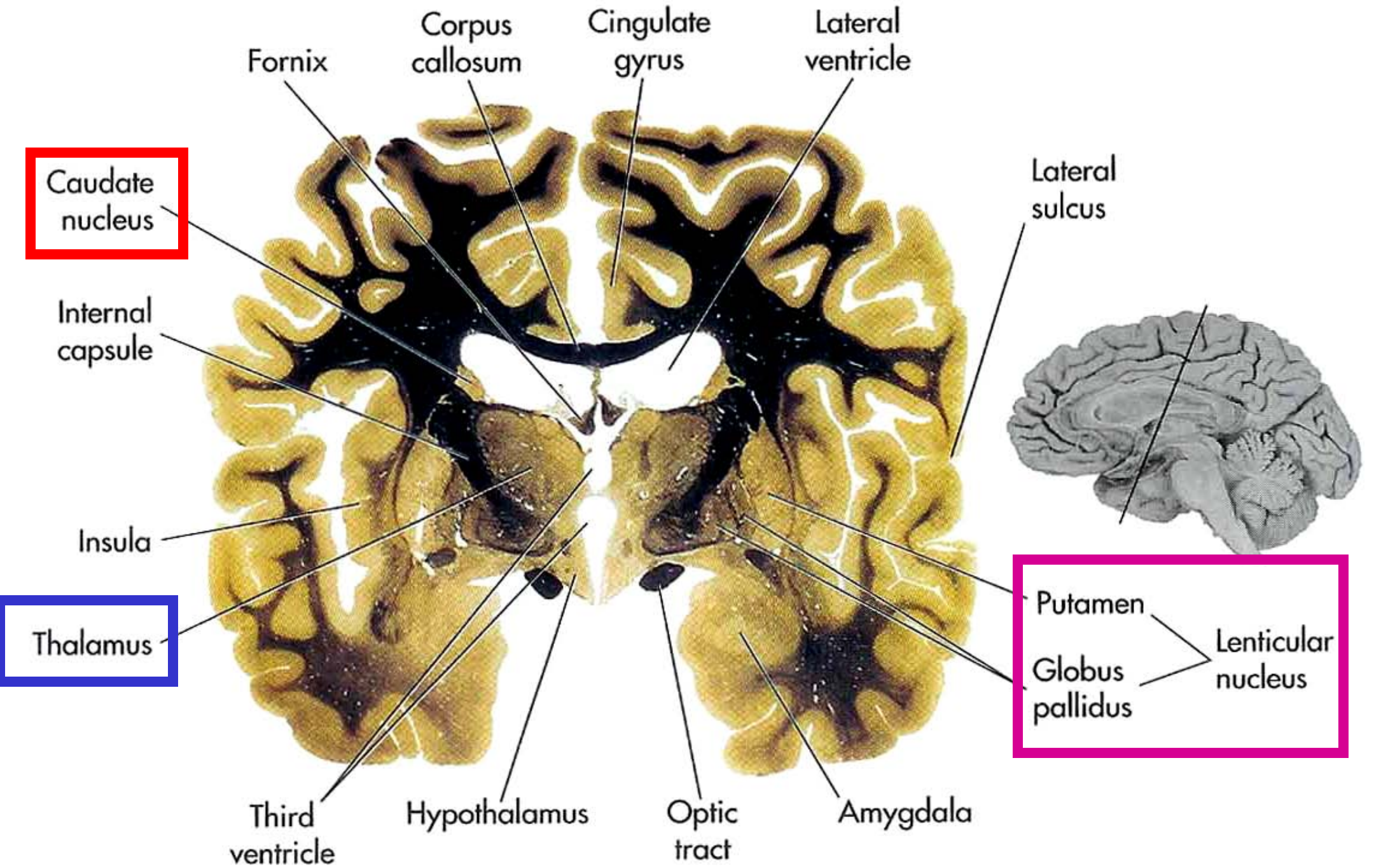
Insula and operculum



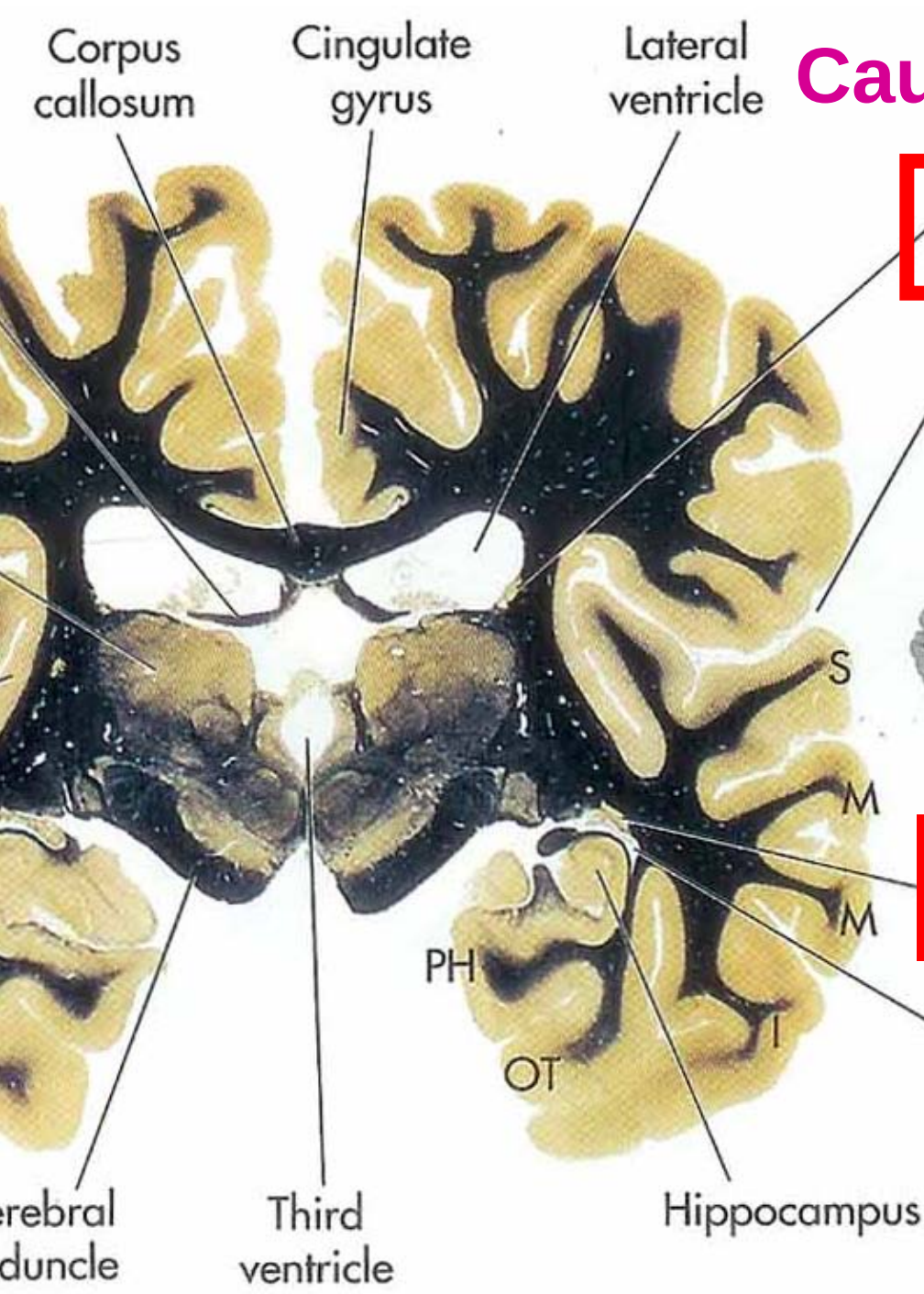
https://radiopaedia.org/articles/circular-sulcus?lang=us

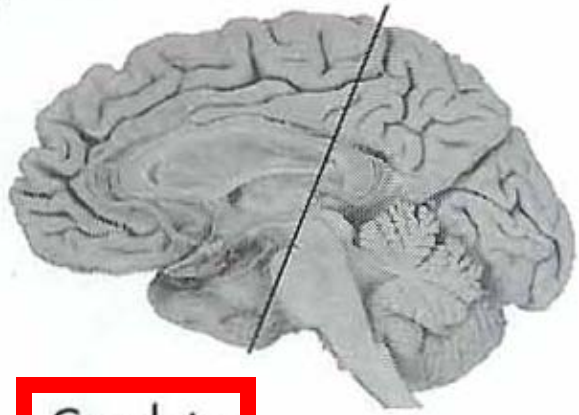


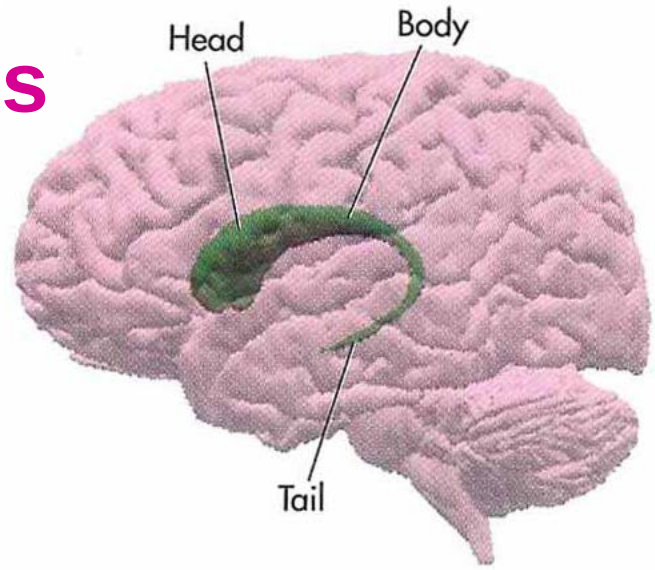

Interventricular foramen
Fornix
Roof of the third ventricle
Thalamus
Pineal gland
Superior colliculus
Inferior colliculus
Cerebral aqueduct
Anterior commissure
Primary fissure
Interthalamic adhesion
Midbrain
Vermis
Fourth ventricle
Optic chiasm
Basal pons
Tegmentum
Vermis
Hypothalamus
Open medulla
Cerebellar hemisphere
Closed medulla
Nodulus


Fornix
Corpus callosum
Cingulate gyrus
Lateral ventricle
Caudate nucleus
Lateral sulcus
Internal capsule
Insula
Thalamus
Putamen
Globus pallidus
Lenticular nucleus
Third ventricle
Hypothalamus
Optic tract
Amygdala

Caudate nucleus

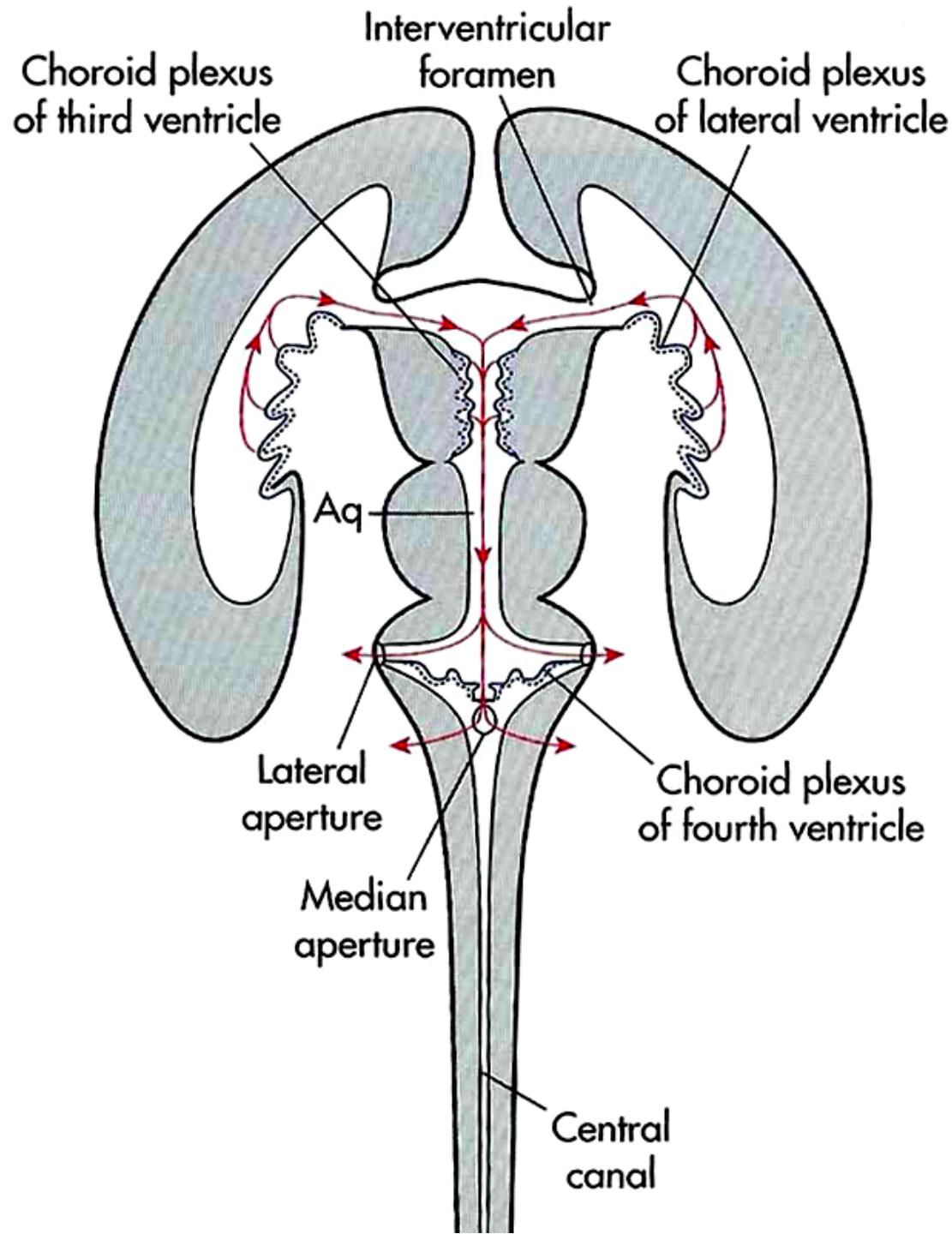






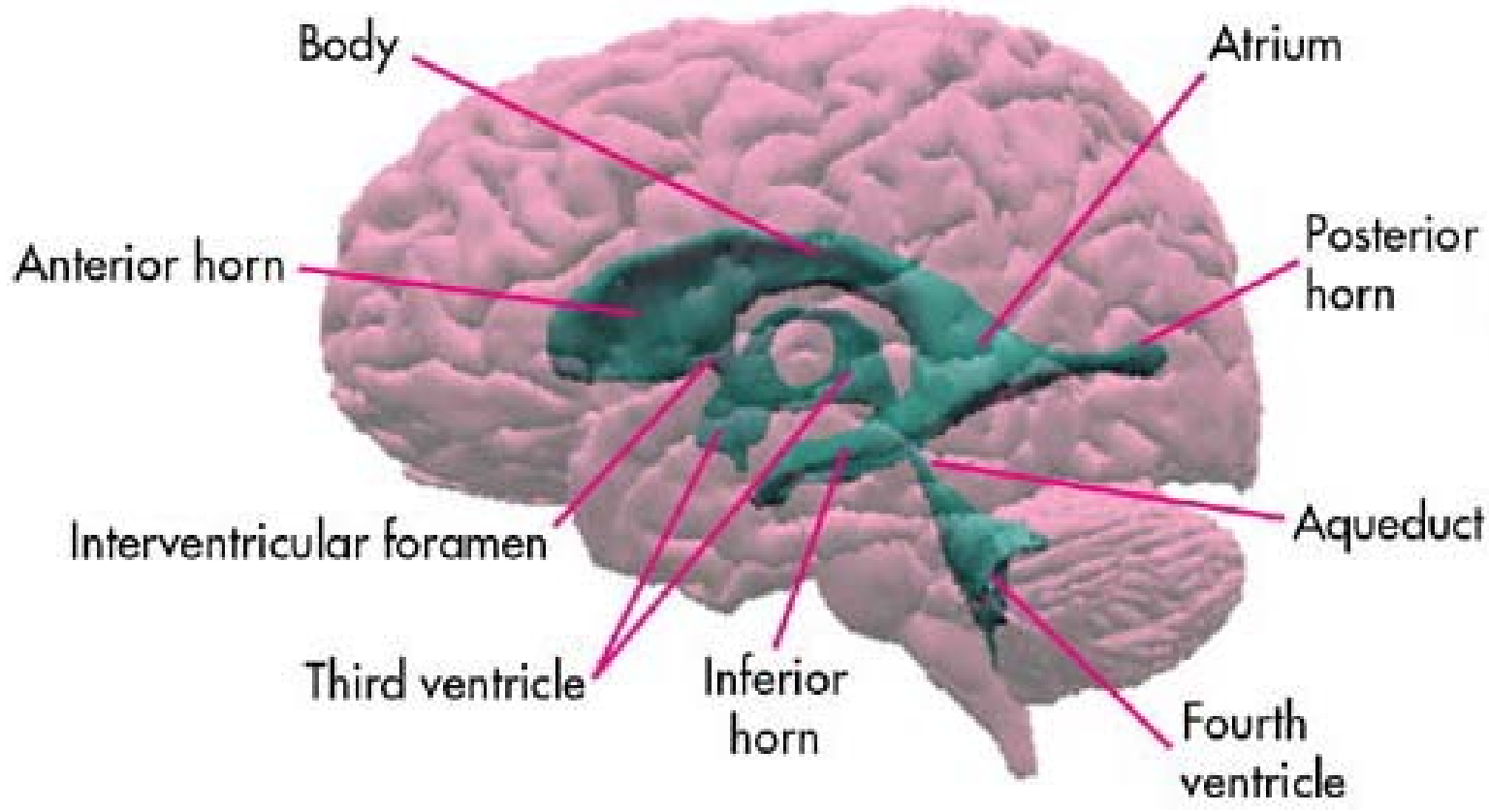
CSF circulation

- Choroid plexuses →
- lateral ventricle →
- interventricular foramen →
- 3rd ventricle →
- cerebral aqueduct →
- 4th ventricle apertures →
  - Median and Lateral
- subarachnoid space (cisterns) →
- arachnoid granulation →
- superior sagittal sinus

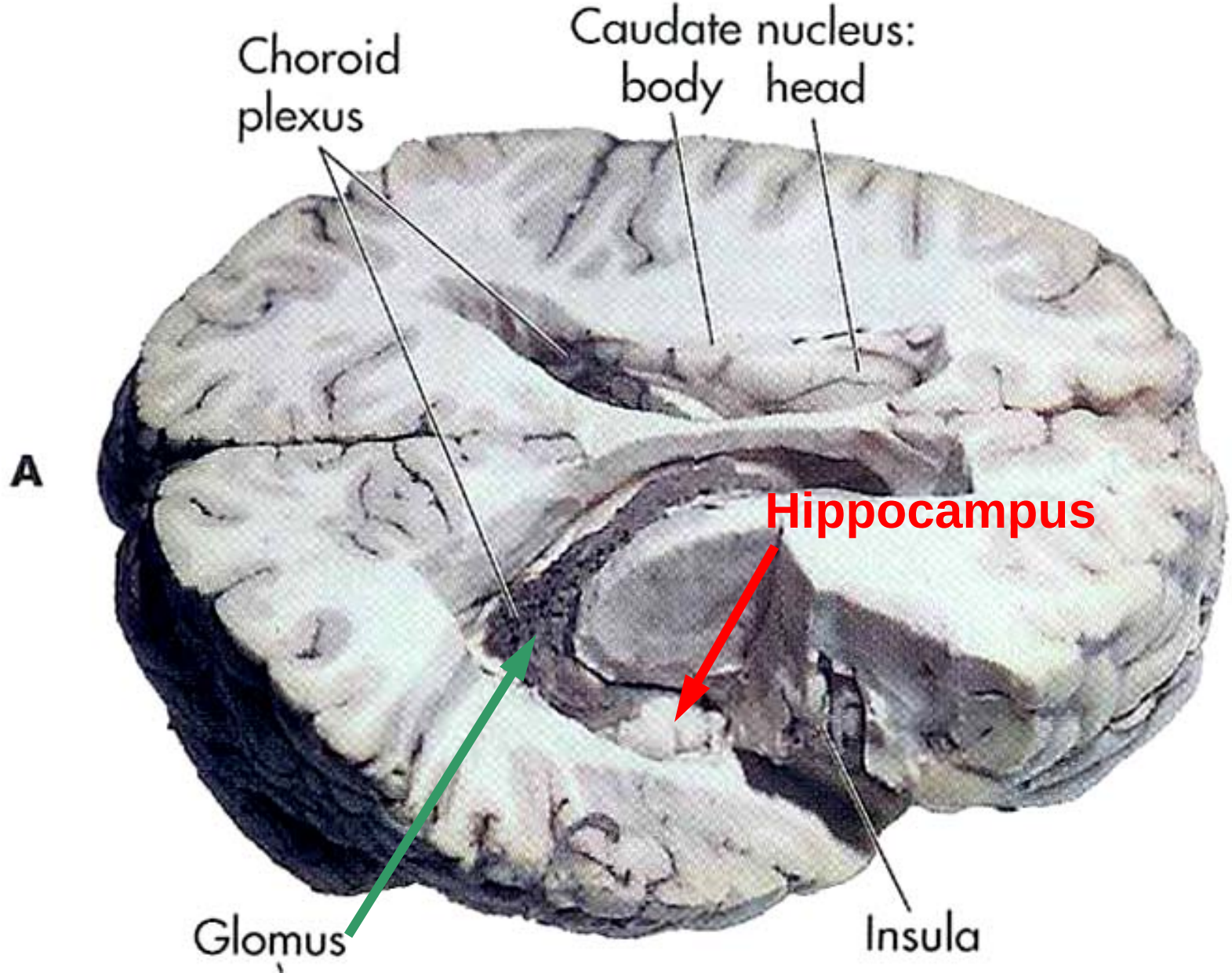


Lateral ventricle

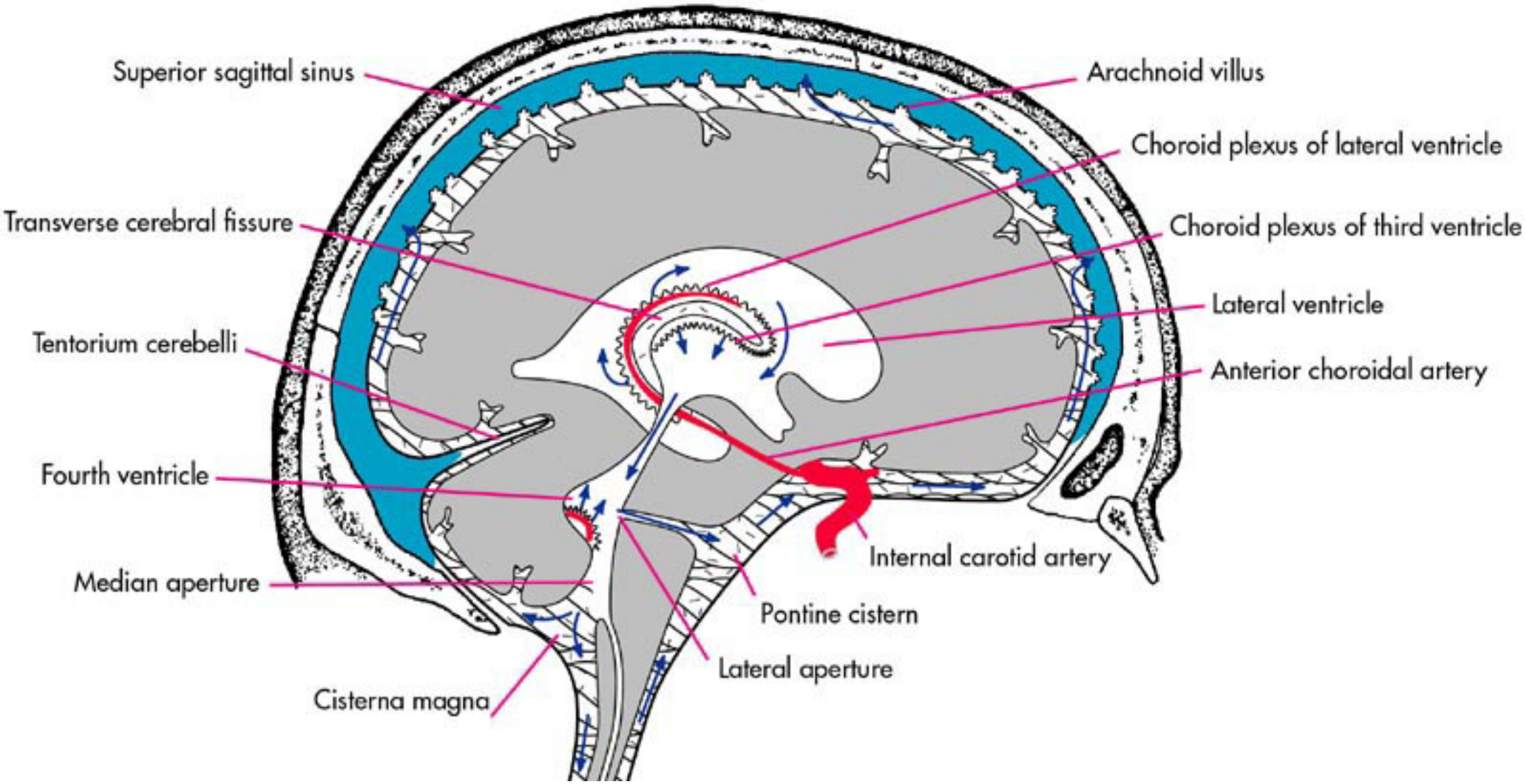
- Anterior horn
- Posterior horn
- Inferior horn
- Atrium (Trigon)
- Body
- Interventricular foramen

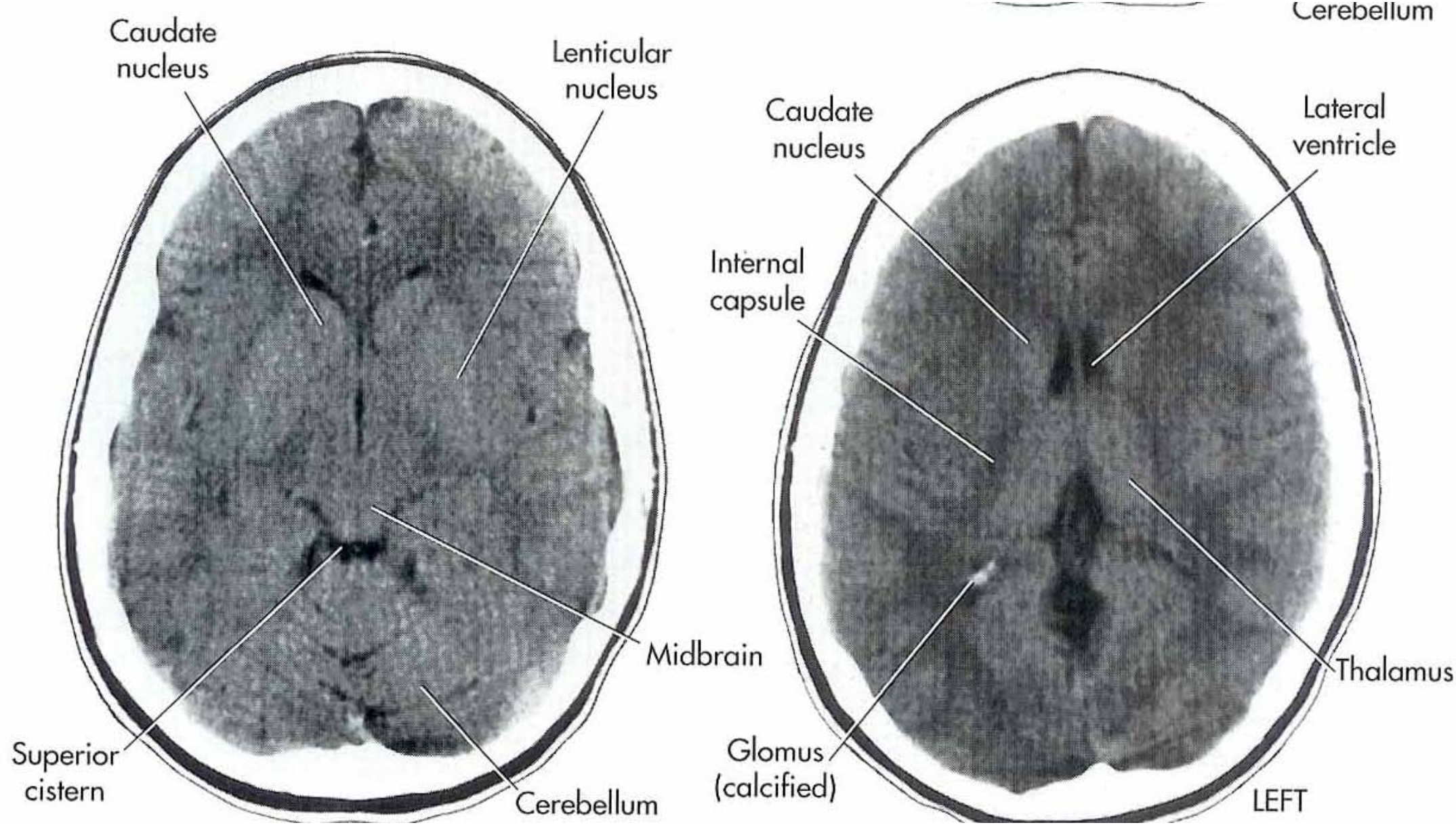


Dissection of Lateral ventricle

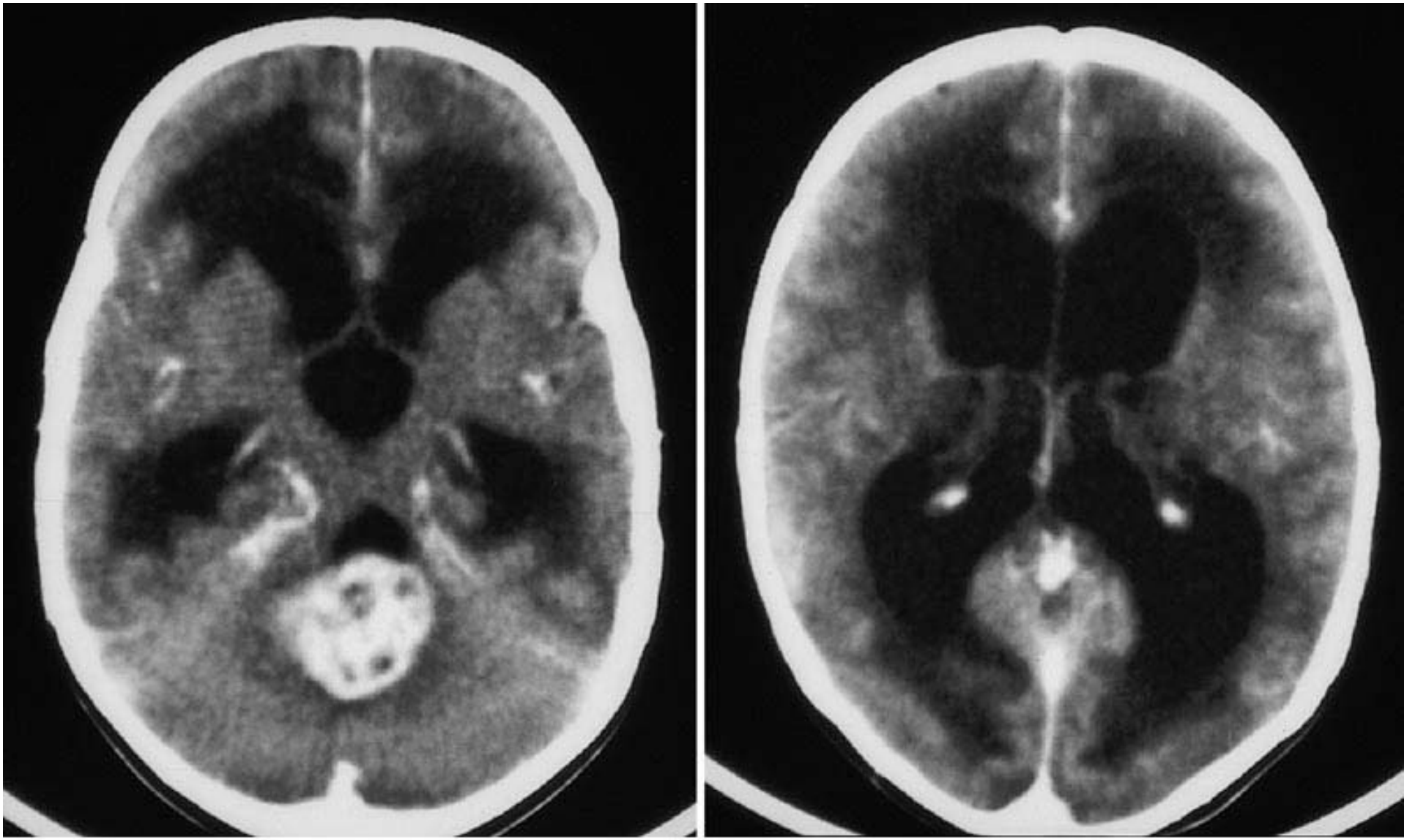


Circulation of CSF



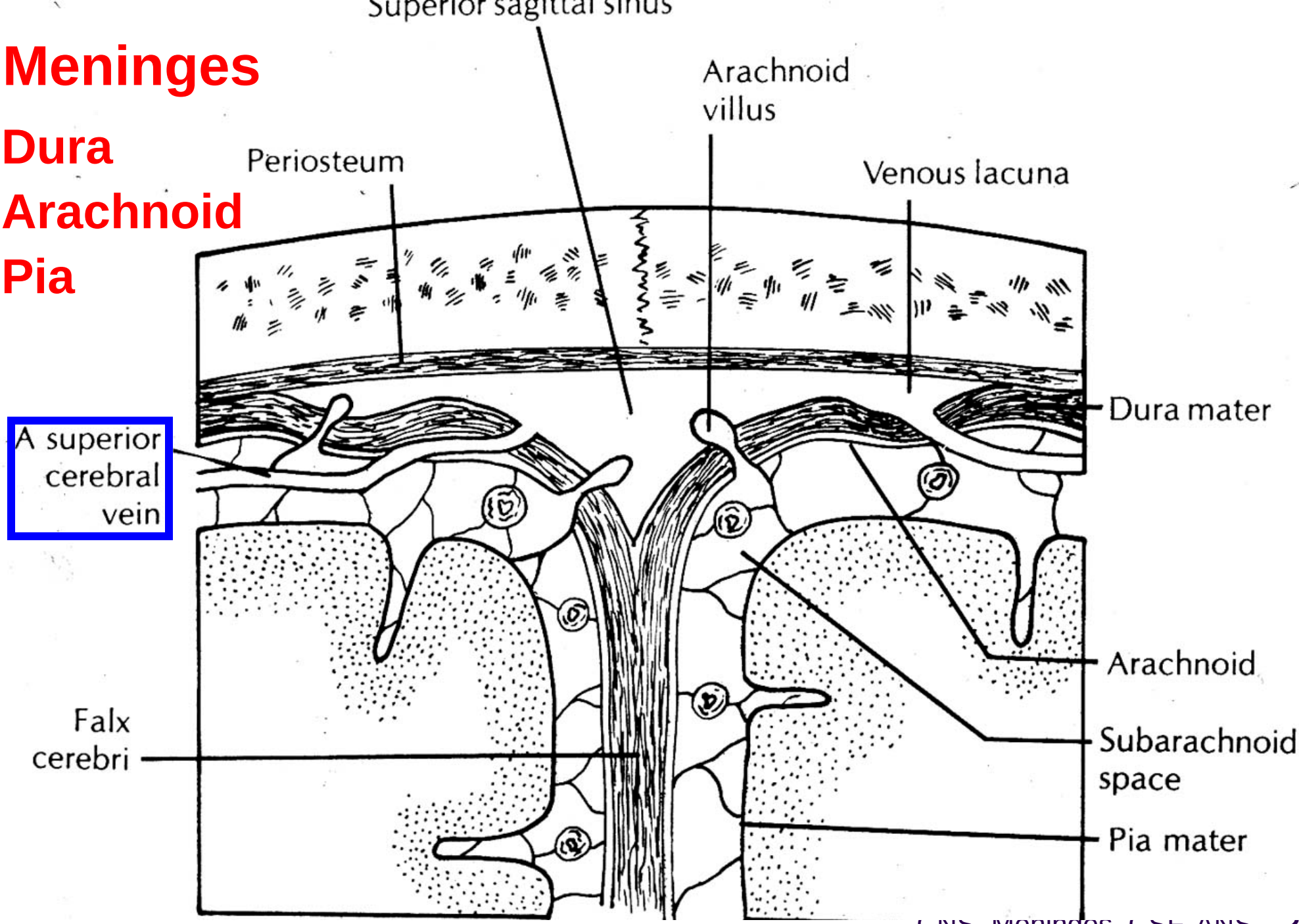

Caudate nucleus
Lenticular nucleus
Midbrain
Superior cistern
Cerebellum
Cerebellum
Caudate nucleus
Lateral ventricle
Internal capsule
Thalamus
Glomus (calcified)
LEFT

Hydrocephalus

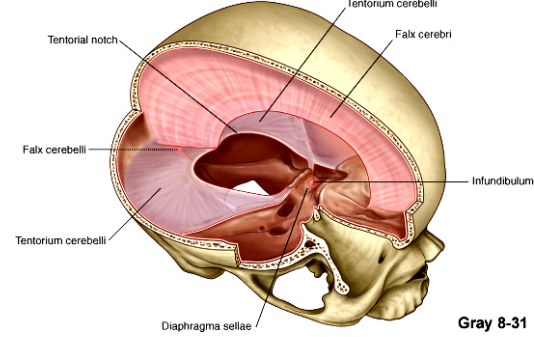


Meninges

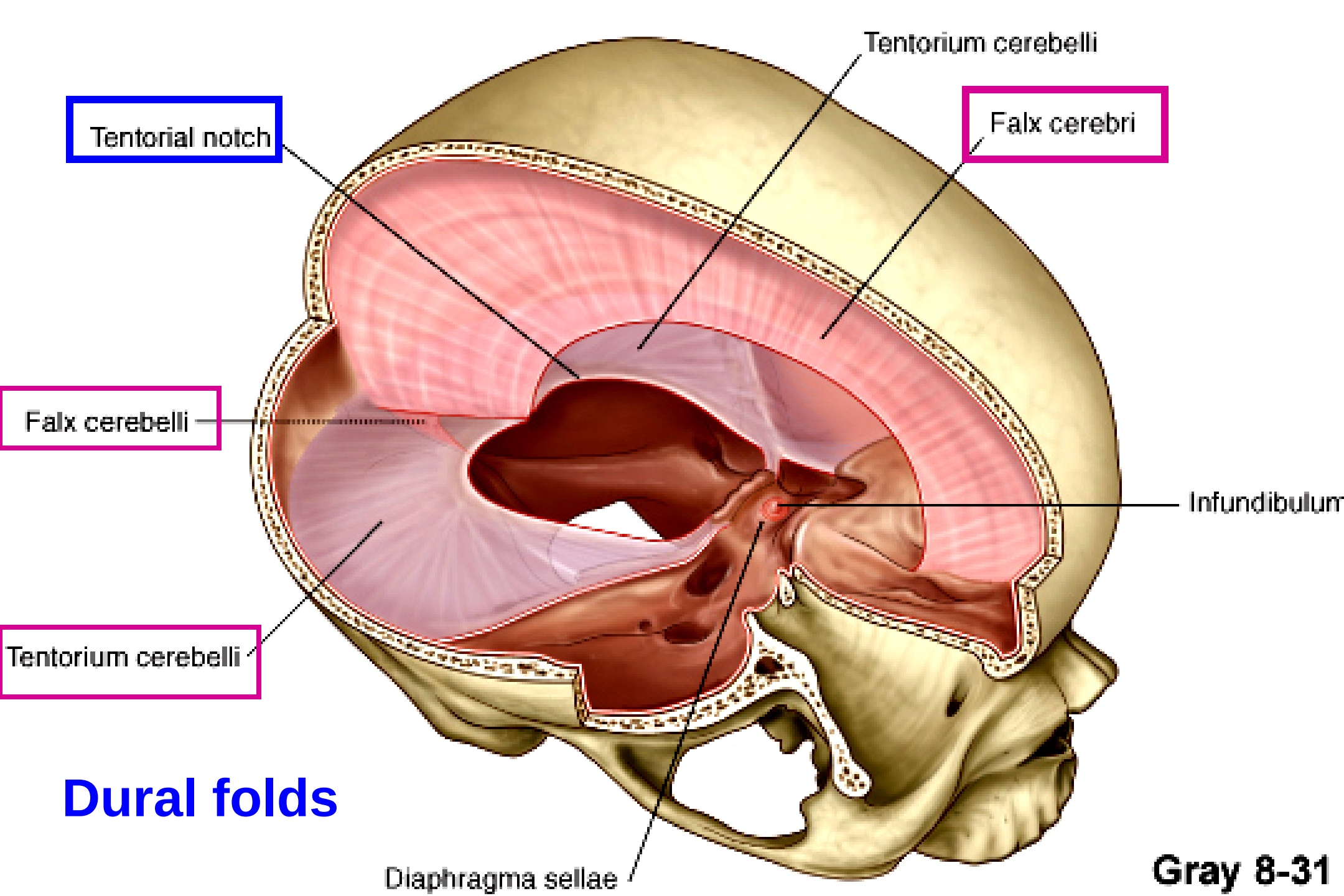
- Dura
- Arachnoid
- Pia



Dural Reflections

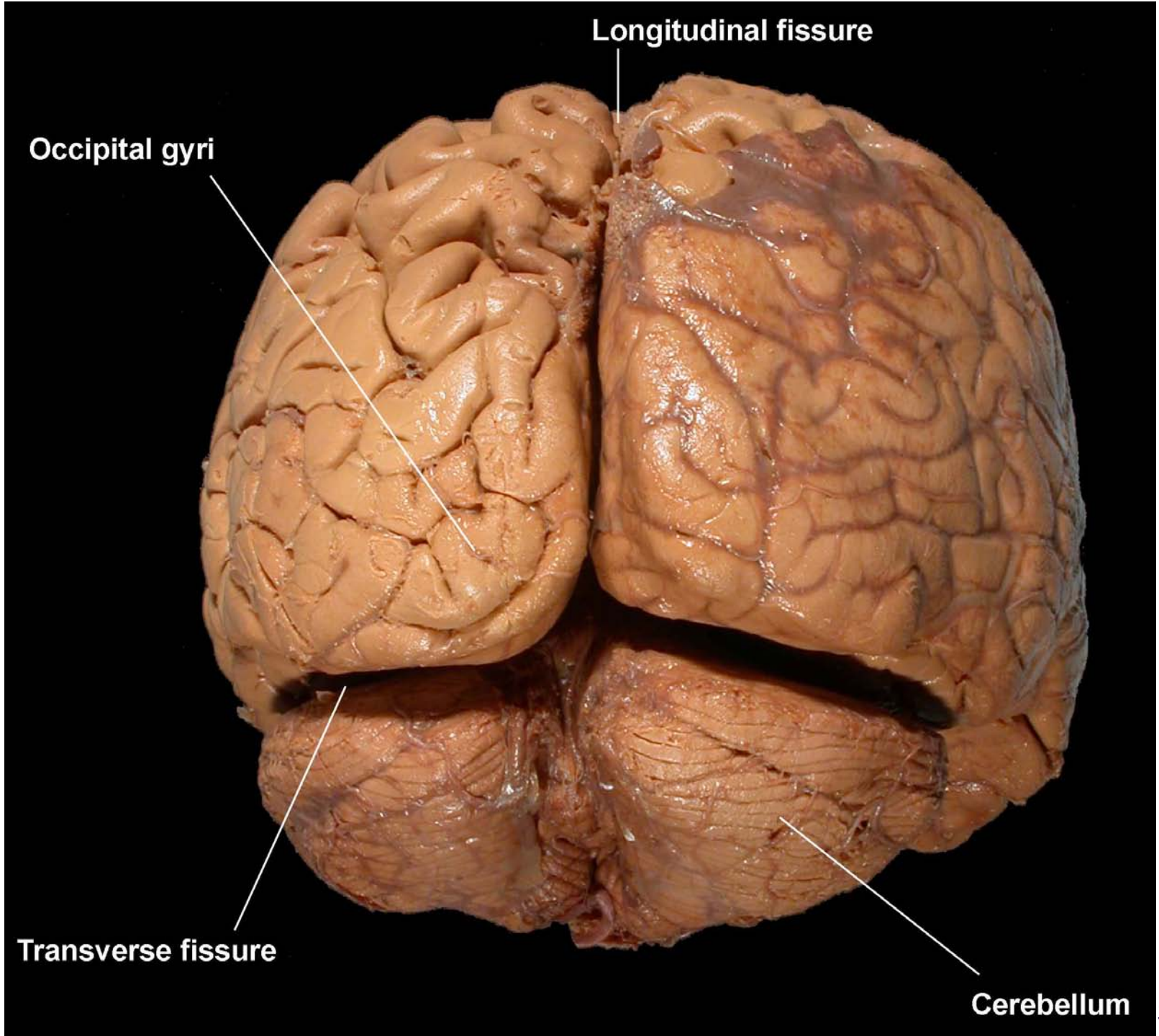


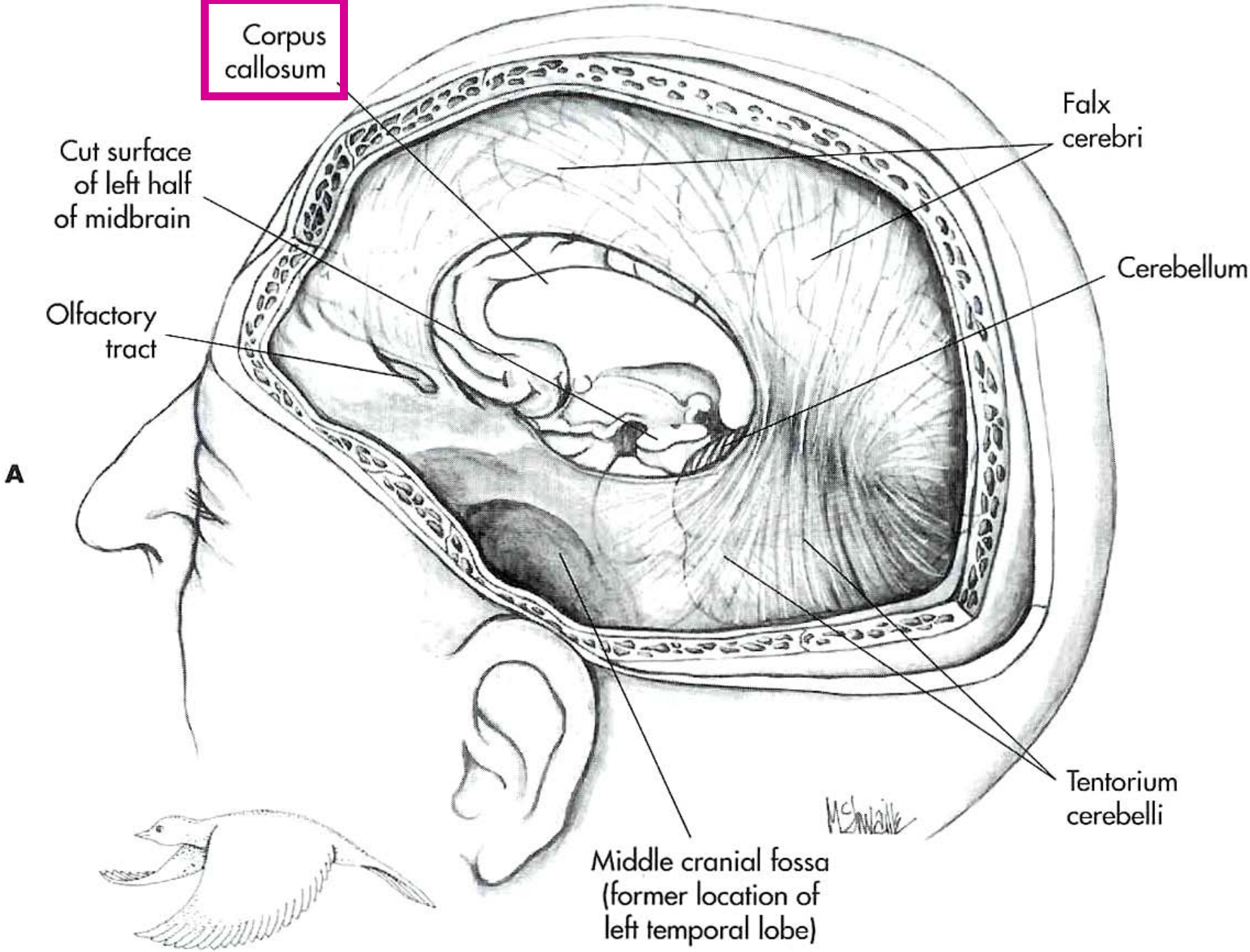
- Falx cerebri: separated in longitudinal fissure; attached to crista galli of ethmoid and tentorium cerebelli
- Tentorium cerebelli: tent-like to separate supra- and infra-tentorial compartment; free edge forming tentorial notch and surrounding *midbrain*
- Falx cerebelli: midline dural fold in posterior fossa; attached to posterior-inferior surface of tentorium cerebelli
- Diaphragma sellae: circular fold, bridge over sella turcica; cover pituitary; with stalk of pituitary passing through the center

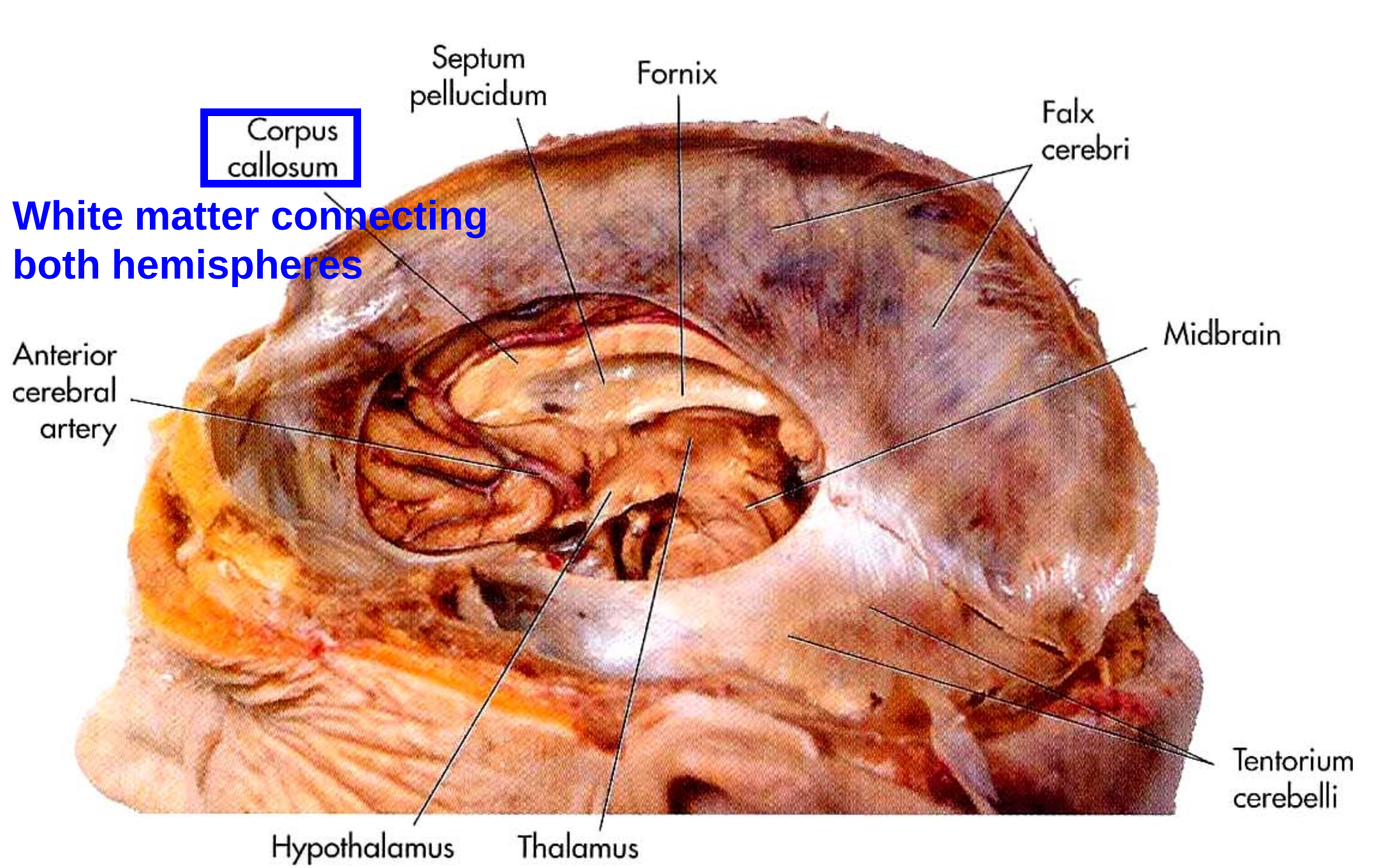


Dural folds

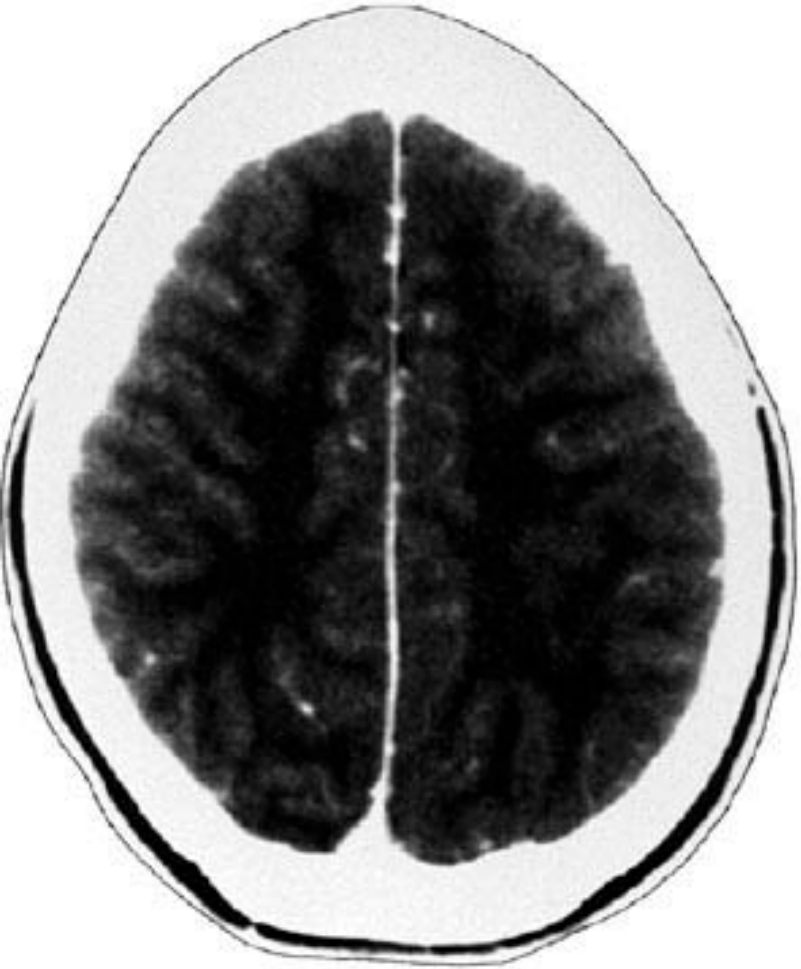
Gray 8-31


Longitudinal fissure
Occipital gyri
Transverse fissure
Cerebellum

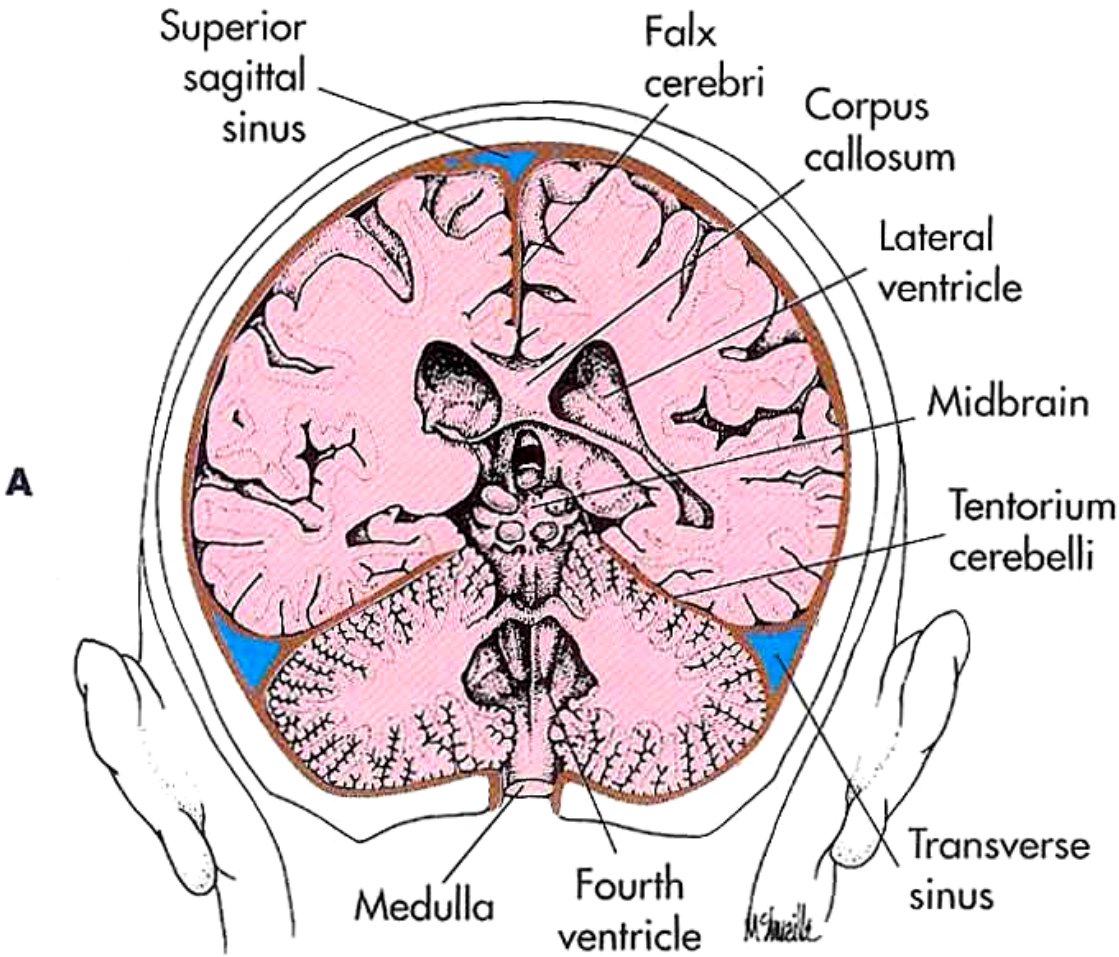

Corpus callosum
Falx cerebri
Cut surface of left half of midbrain
Cerebellum
Olfactory tract
A
Tentorium cerebelli
Middle cranial fossa (former location of left temporal lobe)

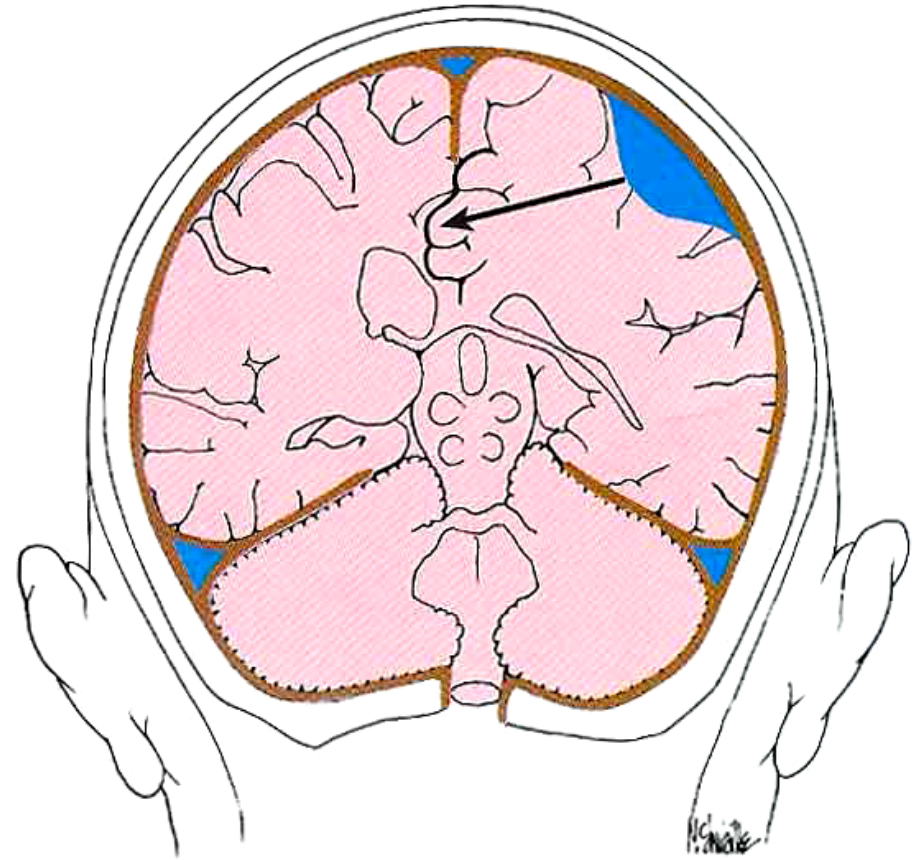

Septum pellucidum
Fornix
Corpus callosum
Falx cerebri
White matter connecting both hemispheres
Midbrain
Anterior cerebral artery
Tentorium cerebelli
Hypothalamus
Thalamus

Fax cerebri and Tentorium cerebelli on MRI



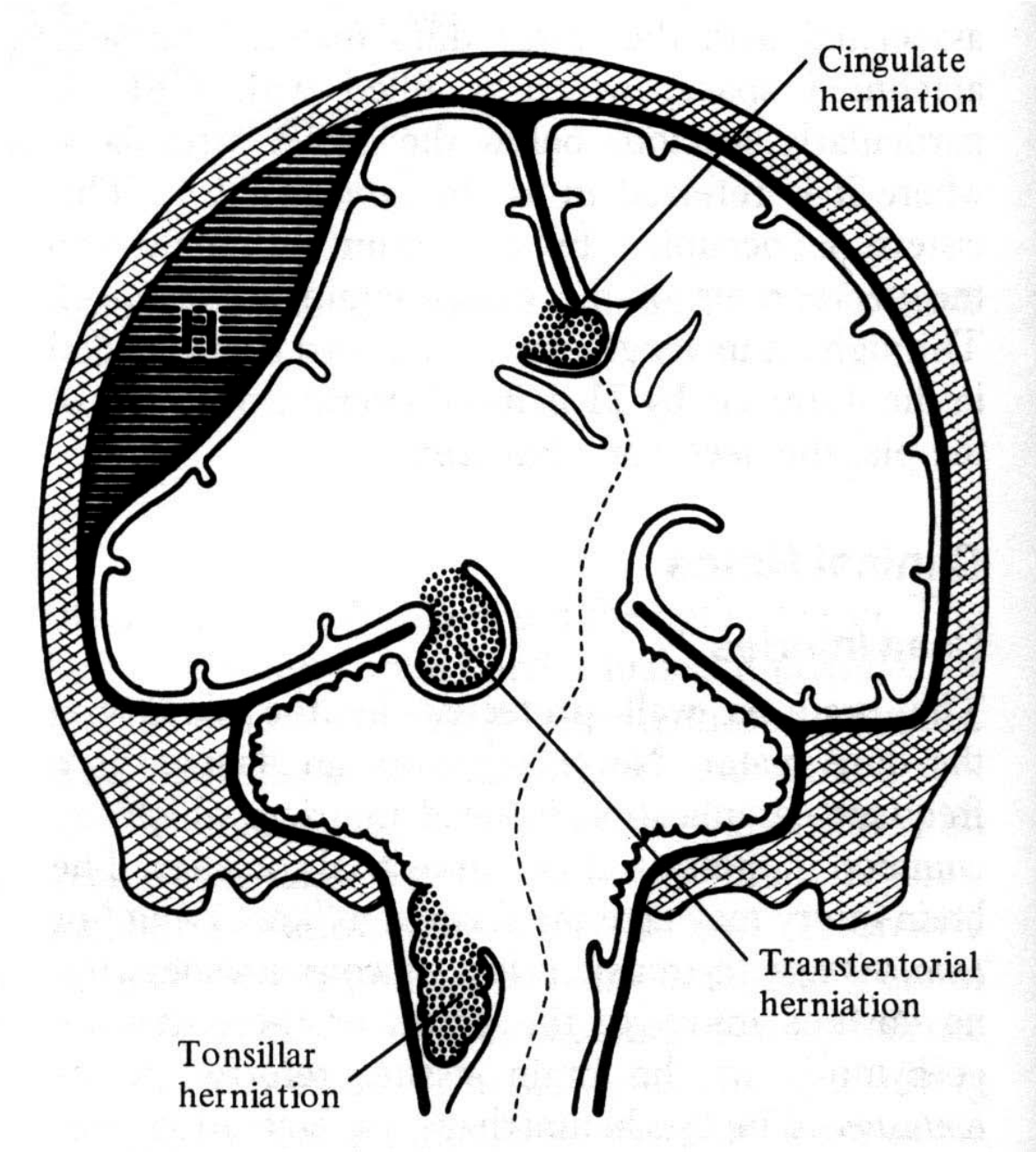
Herniation under falx



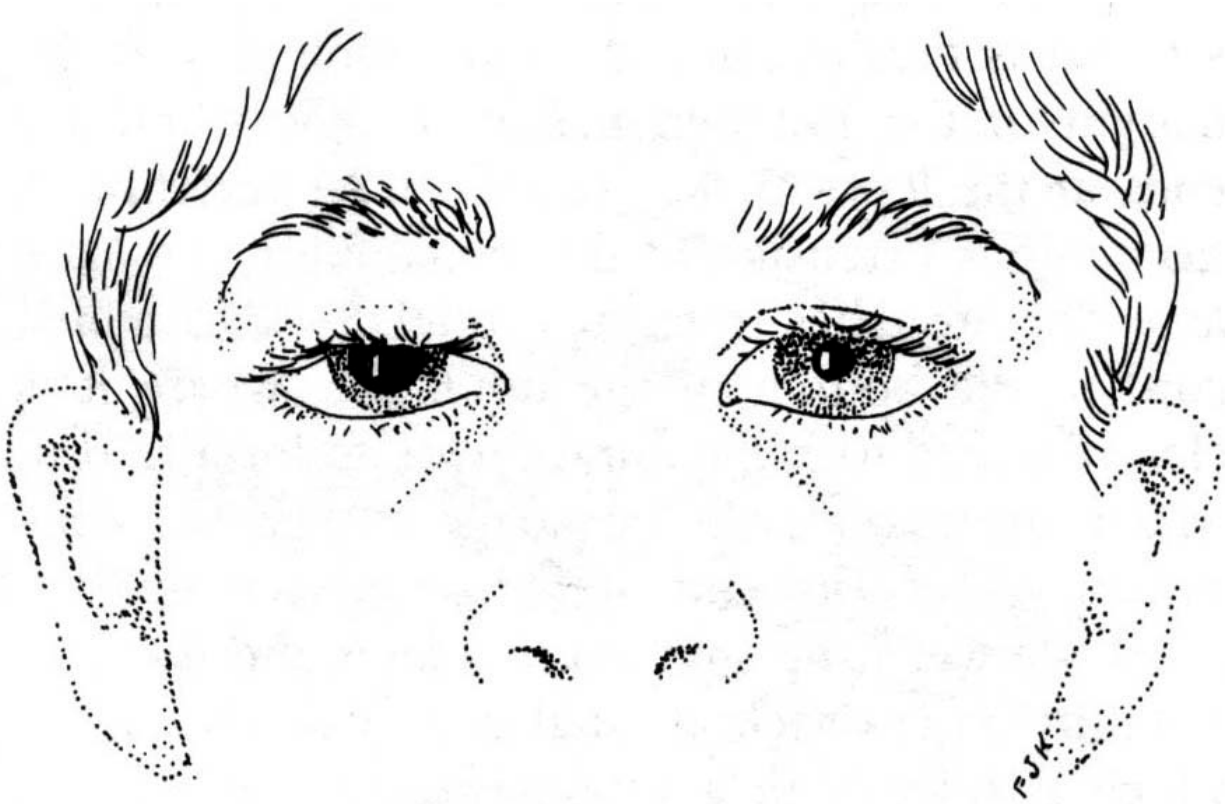


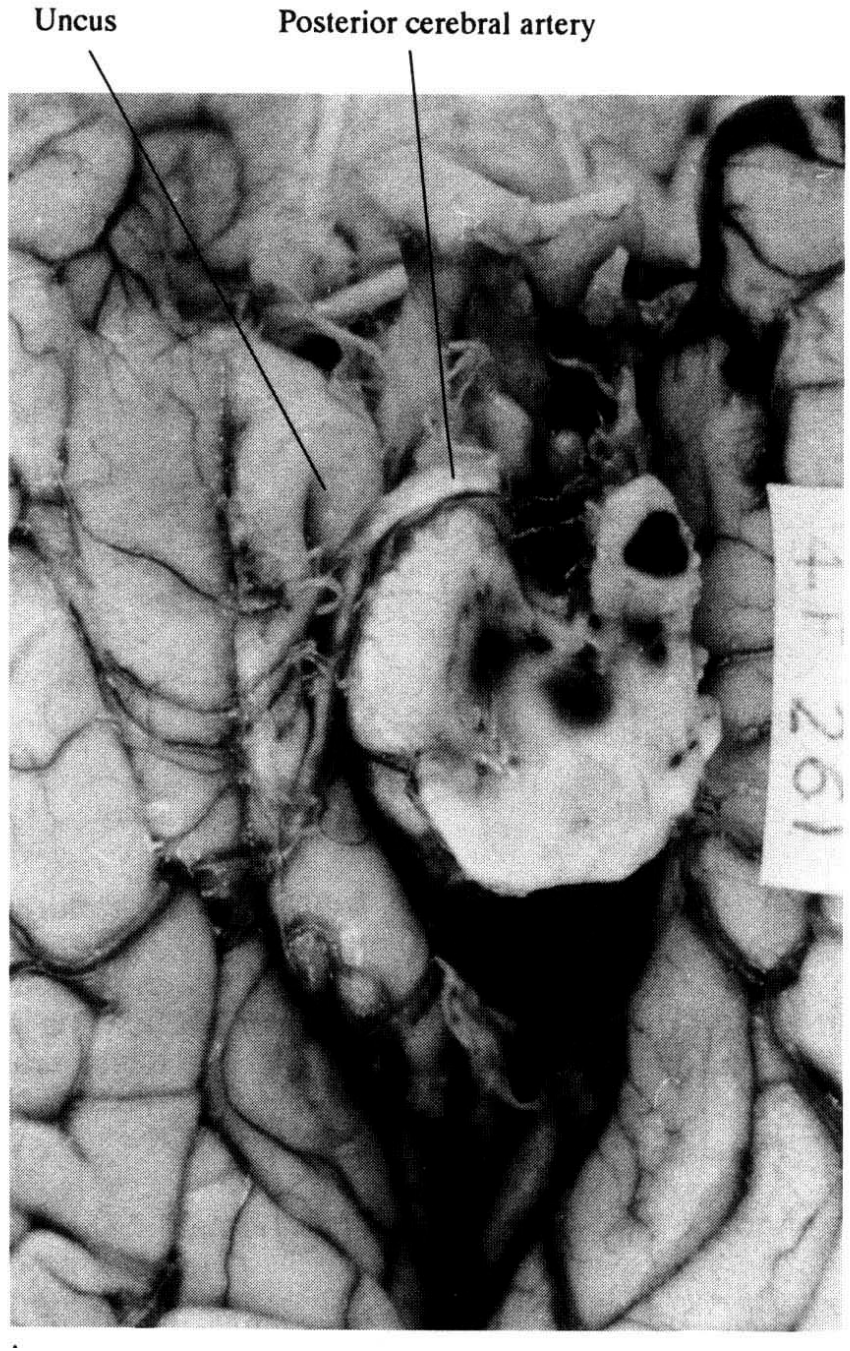
Herniation

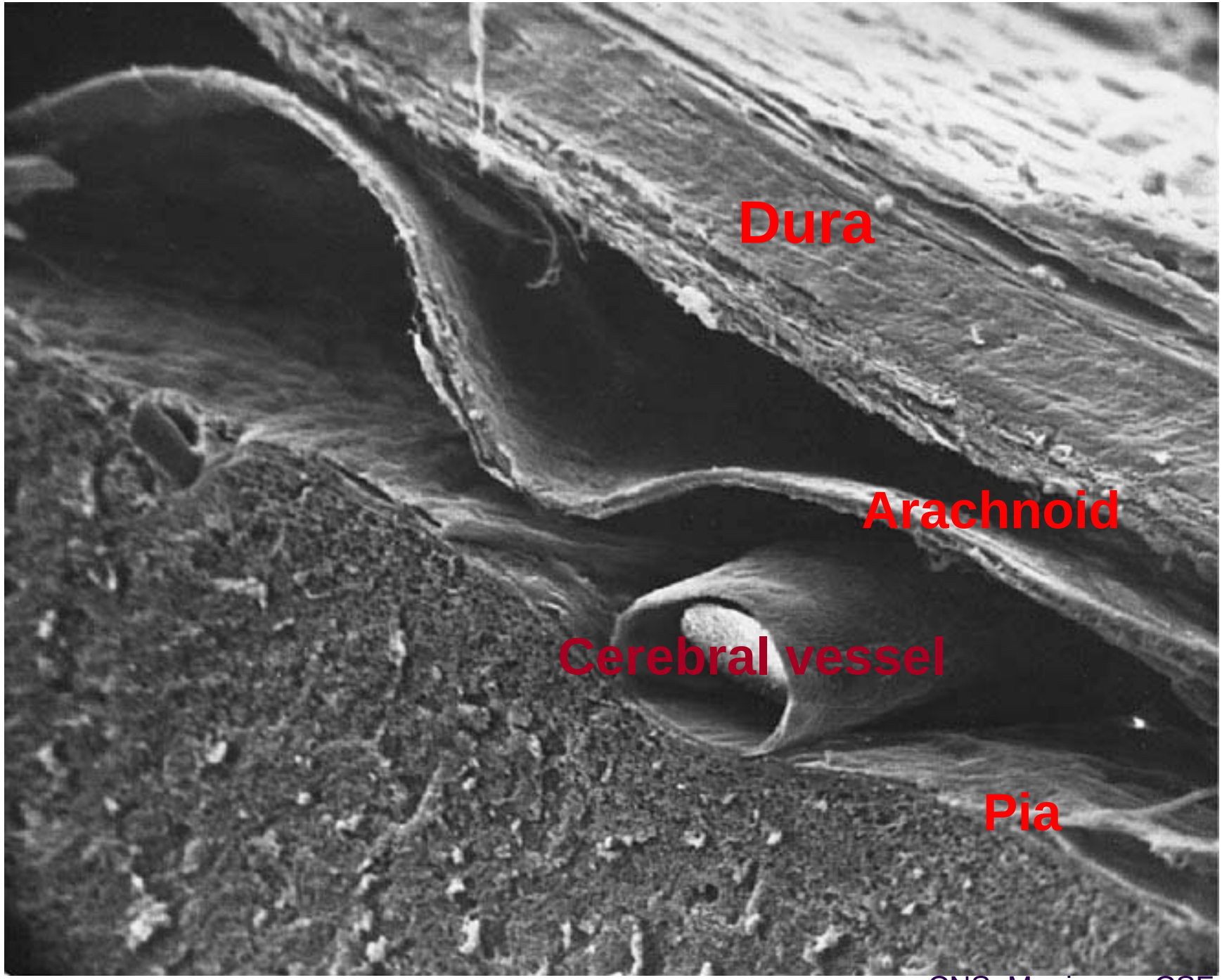
- Cingulate herniation (Subfalcine, Subfalxial)
  - Under falx
- Uncal herniation
  - Transtentorial
- Tonsillar herniation
  - Foramen magnum



Dural reflection: Uncal herniation



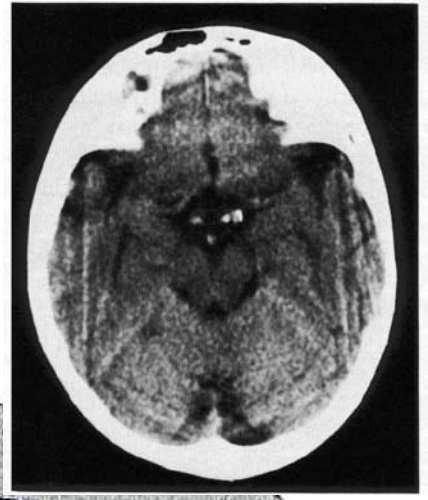



Dura
Arachnoid
Cerebral vessel
Pia

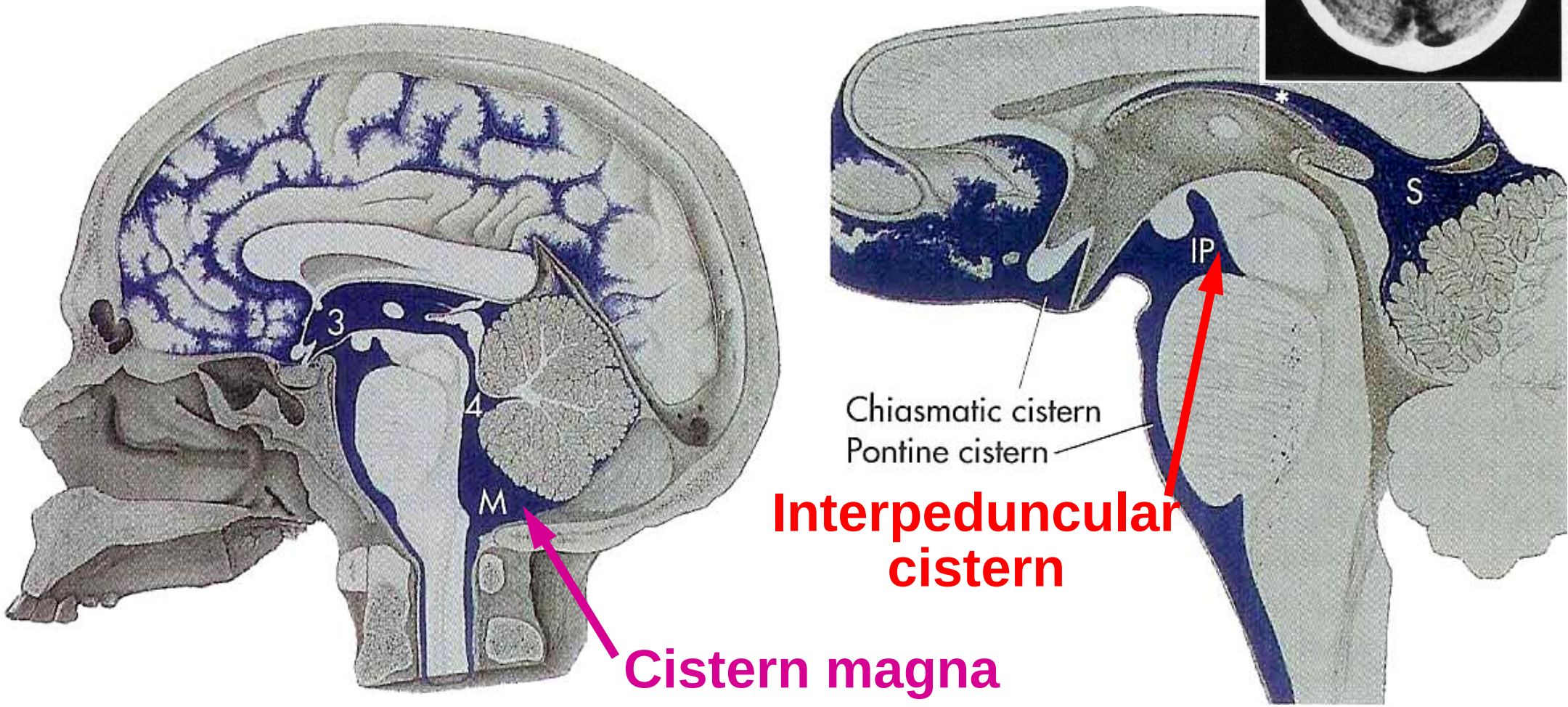
Spaces in Meninges

- Epidural: *potential* space between dura and skull
- Subdural: *potential* space between the innermost dural layer and the dura-arachnoid interface
- Subarachnoid space: normally present; CSF-filled, enlarged cistern, with intact cerebral vessels
  - Basal cistern: pontine cistern, interpeduncular cistern, cistern of the optic chiasma (chiasmatic cistern)
  - Cistern magna
  - Lumbar cistern (L2-S2): containing cauda equina

Cistern

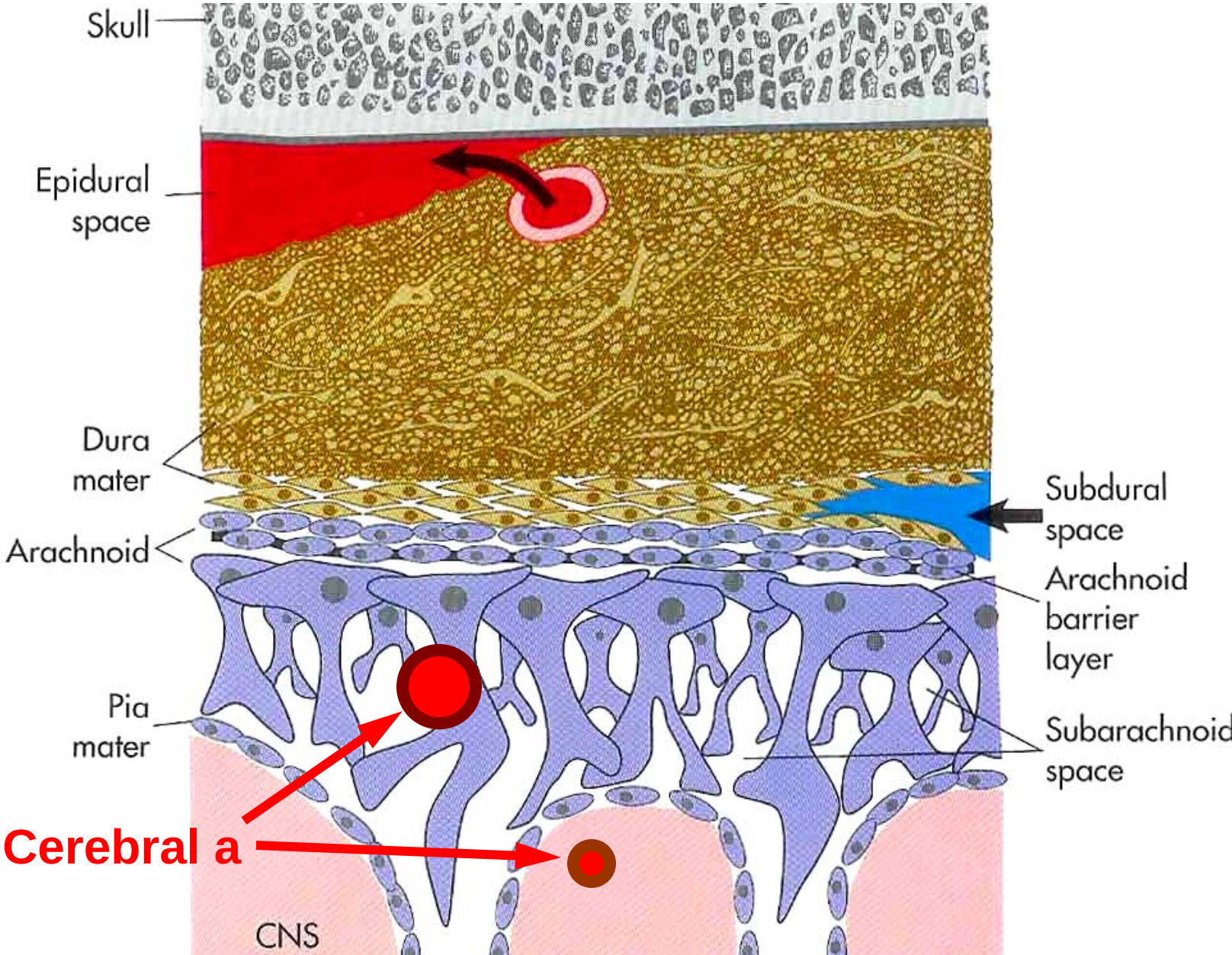


Basal cistern

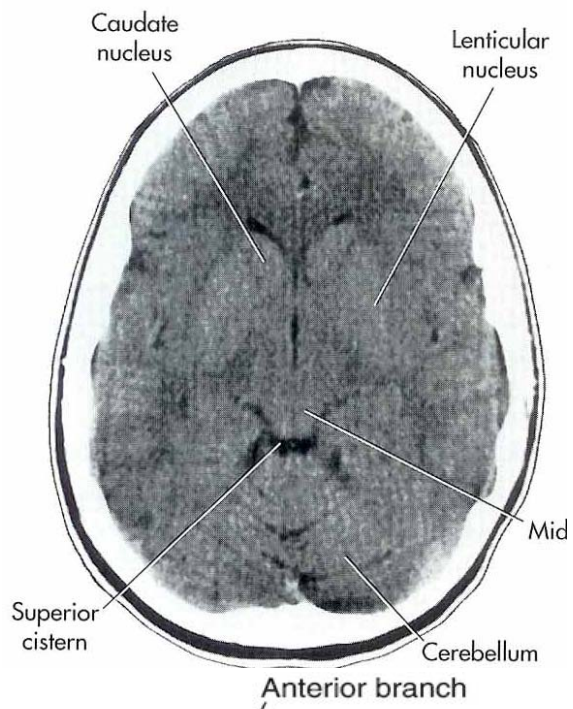


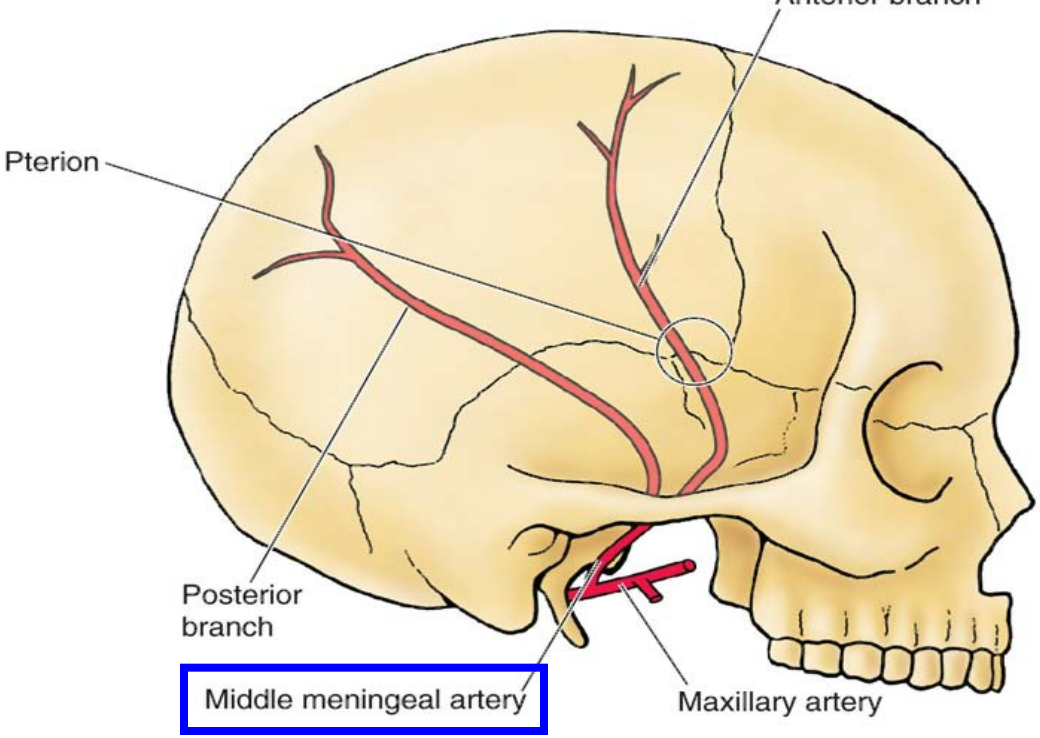
Hemorrhage (bleeding)

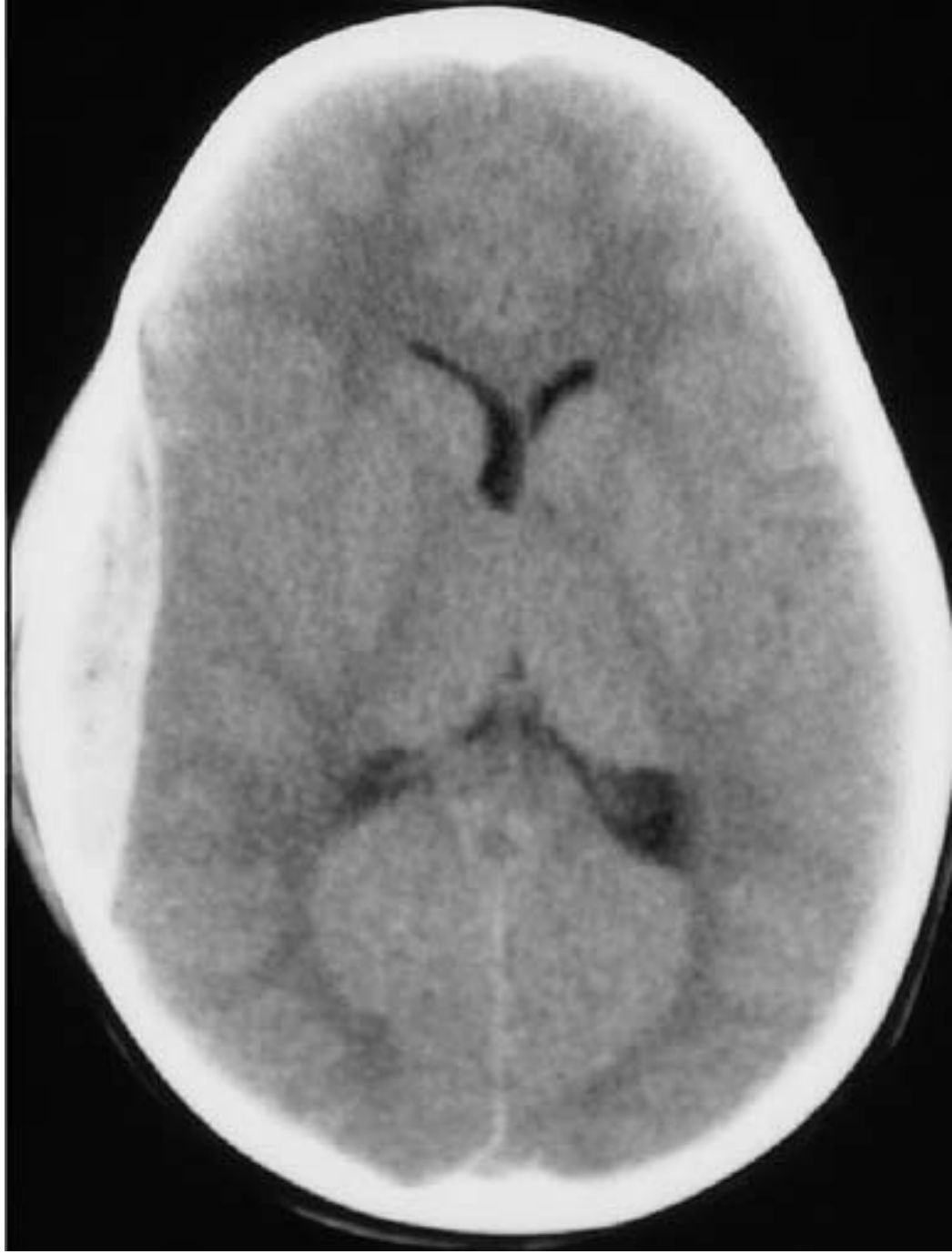
- Meningeal a.: epidural hematoma
- Dural venous sinus: subdural or epidural hematoma
- Cerebral a/v: subarachnoid hemorrage (SAH), intracerebral hemorrhage



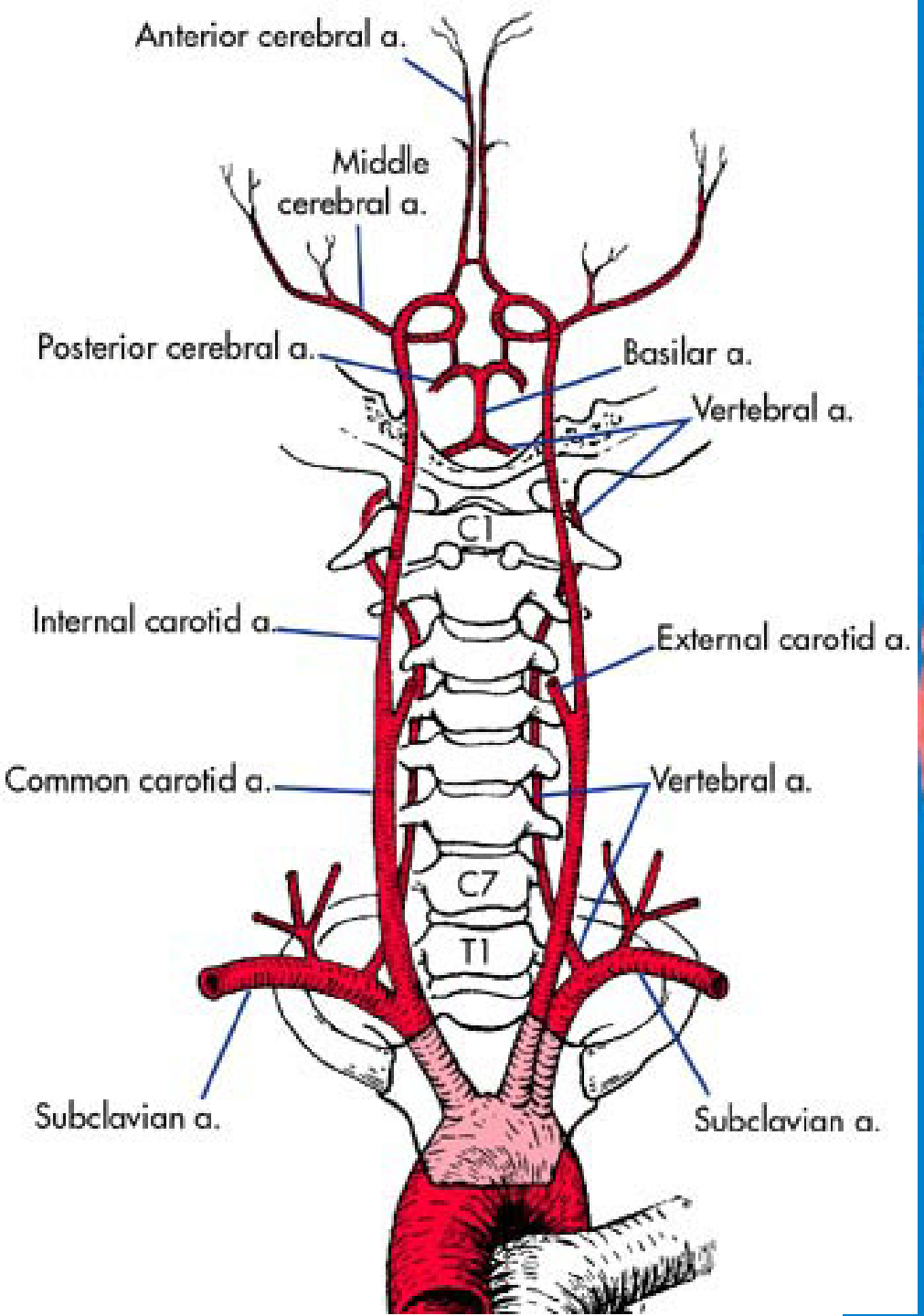
Epidural hematoma

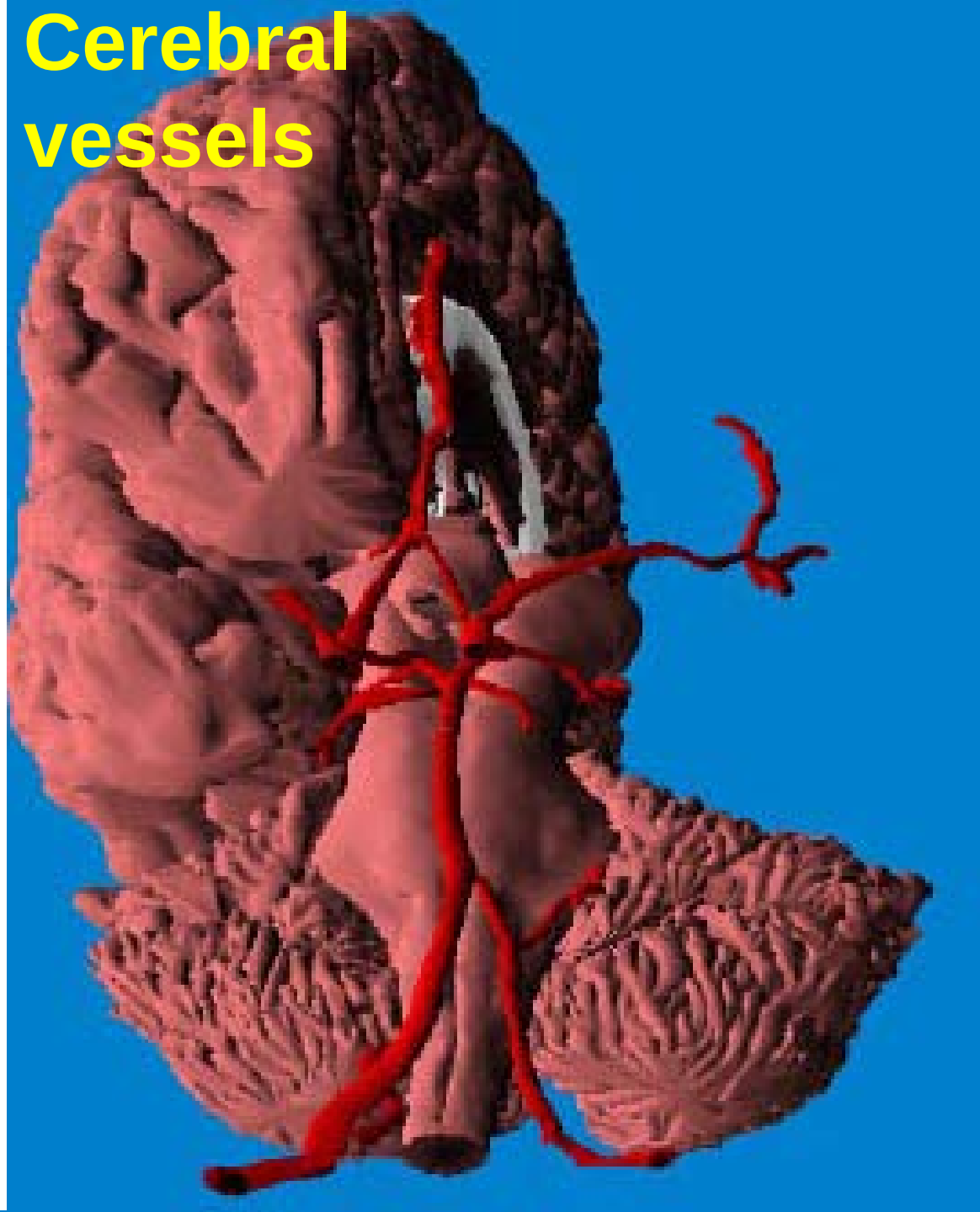


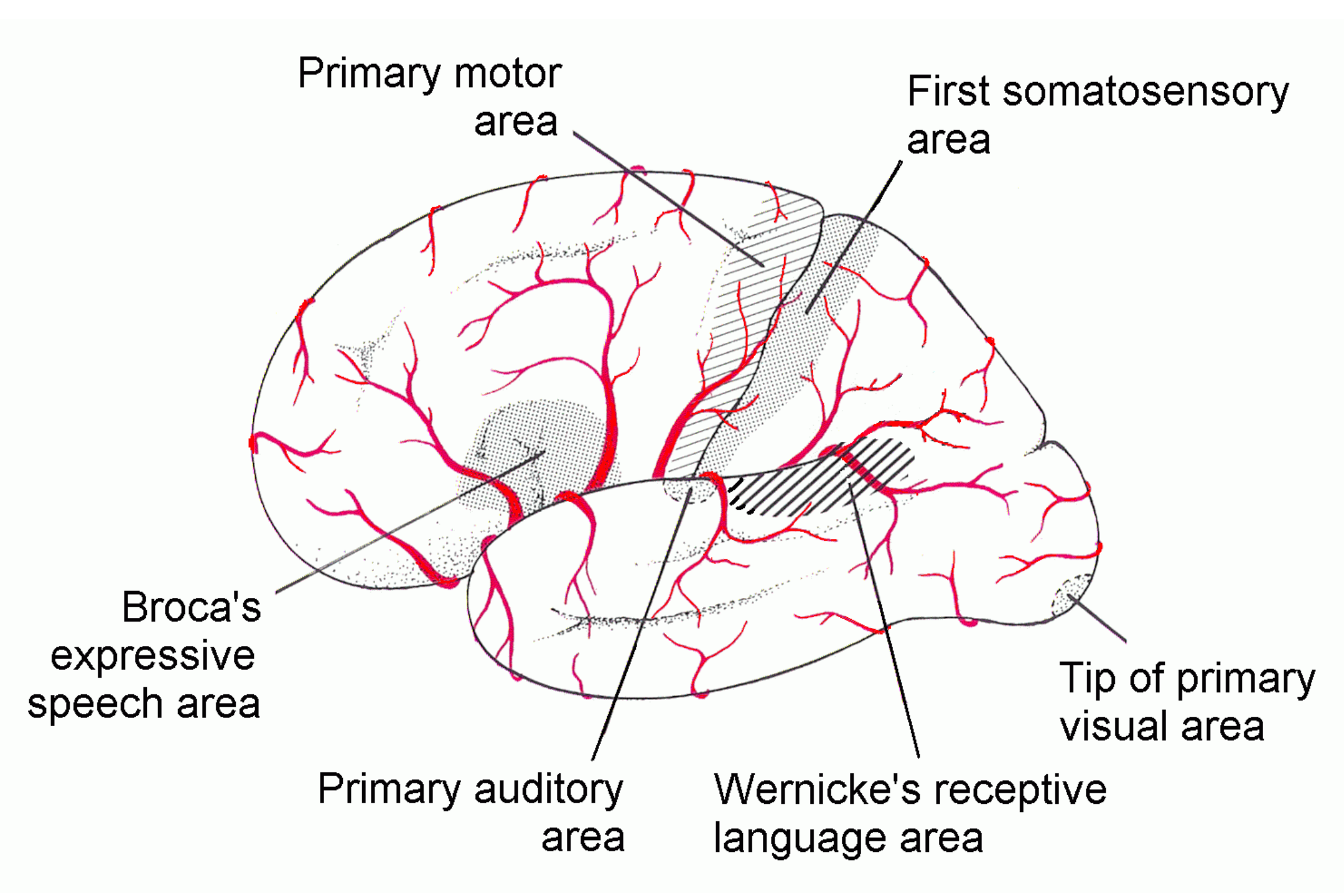


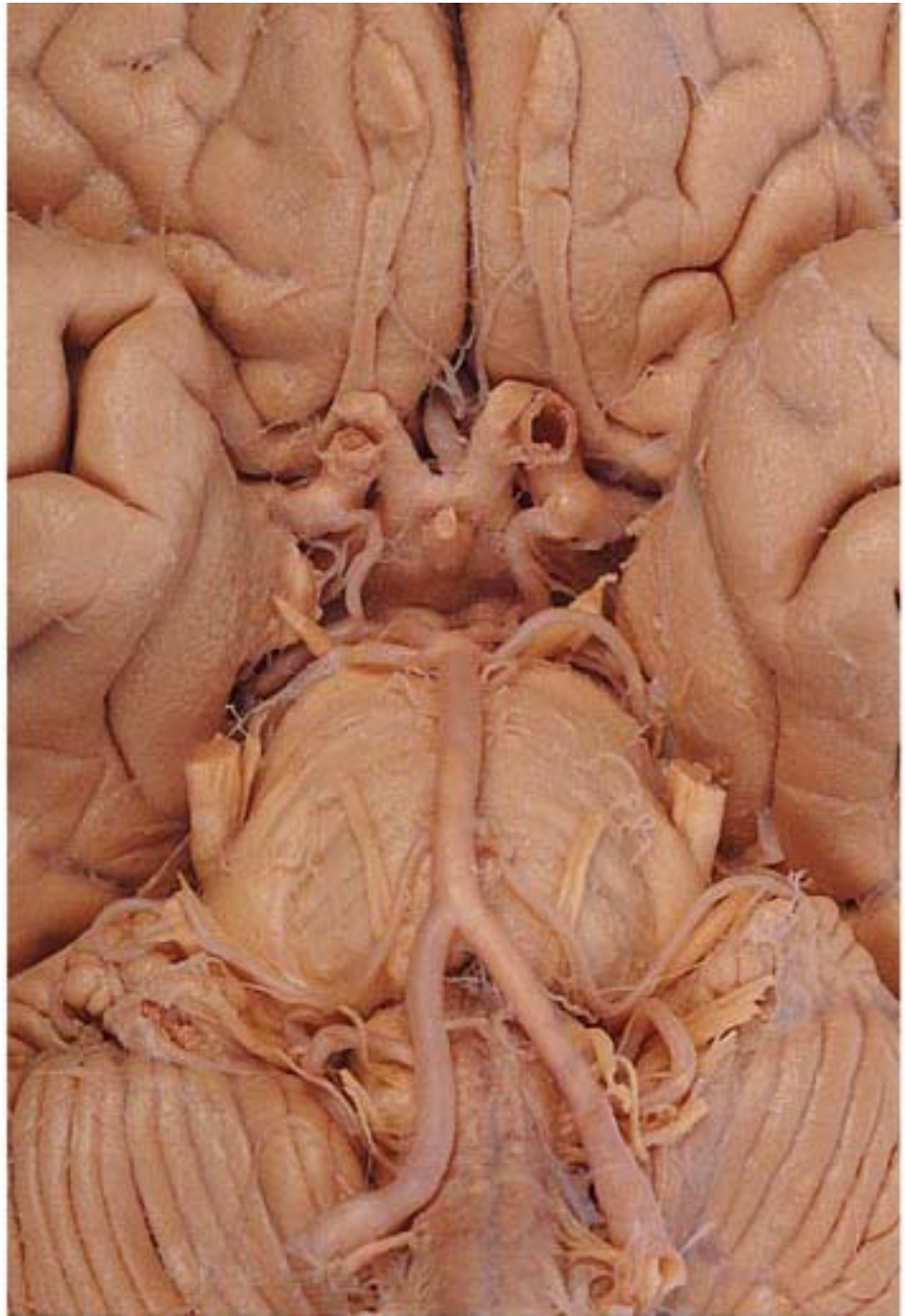


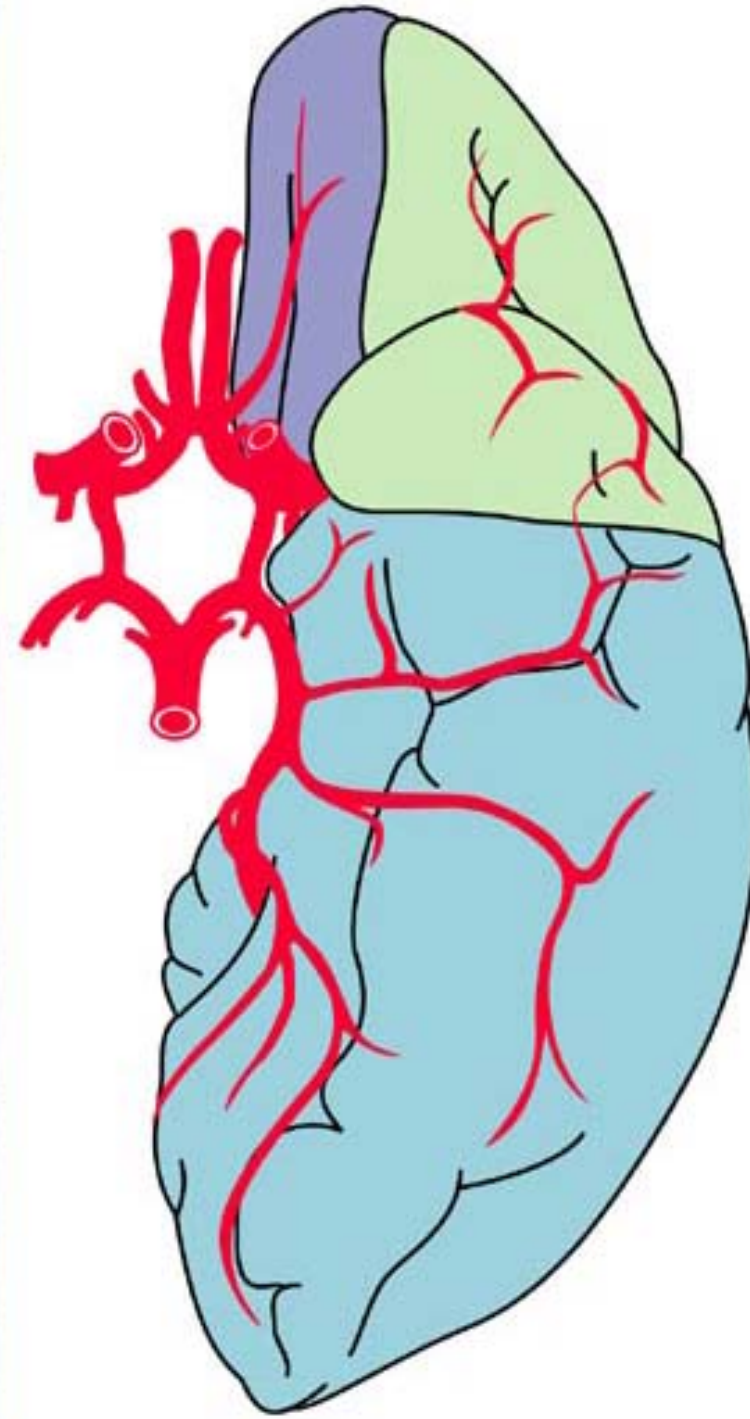
Cerebral vessels



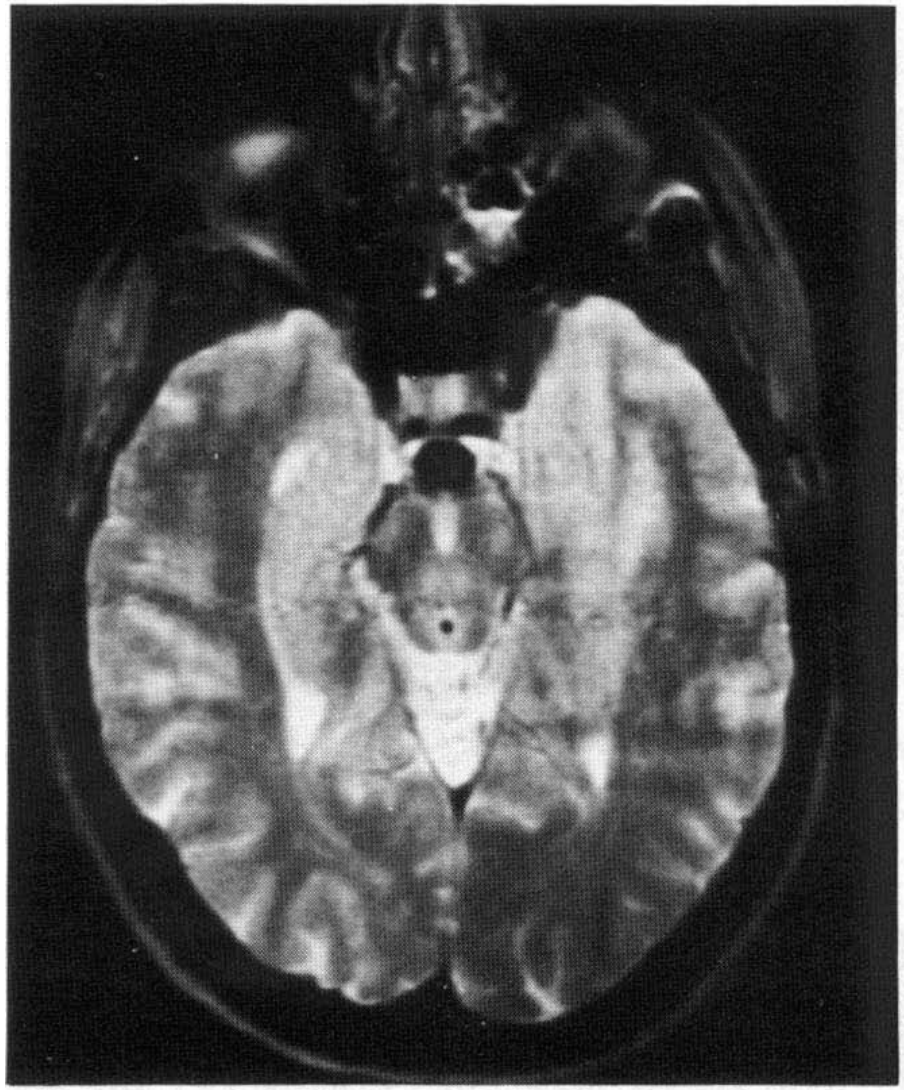



Primary motor area
First somatosensory area
Broca's expressive speech area
Primary auditory area
Wernicke's receptive language area
Tip of primary visual area

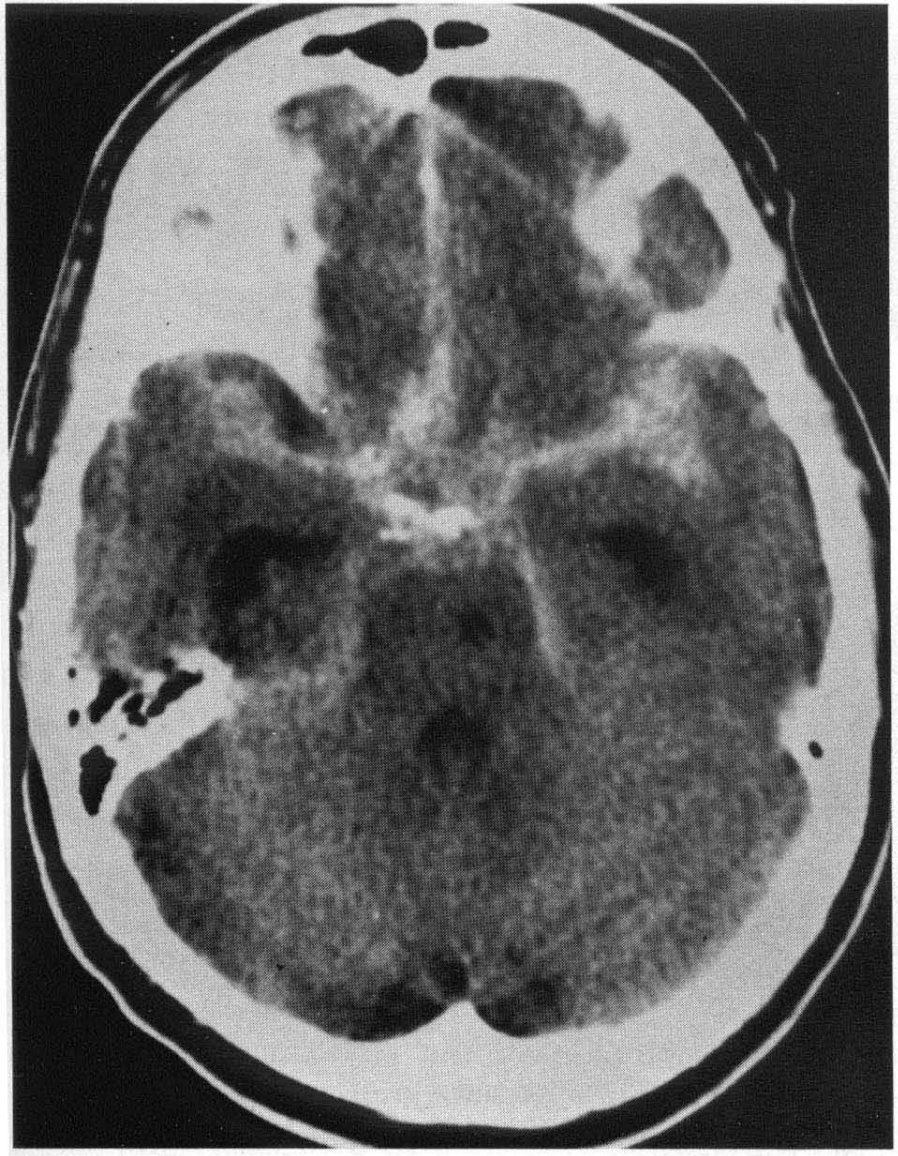


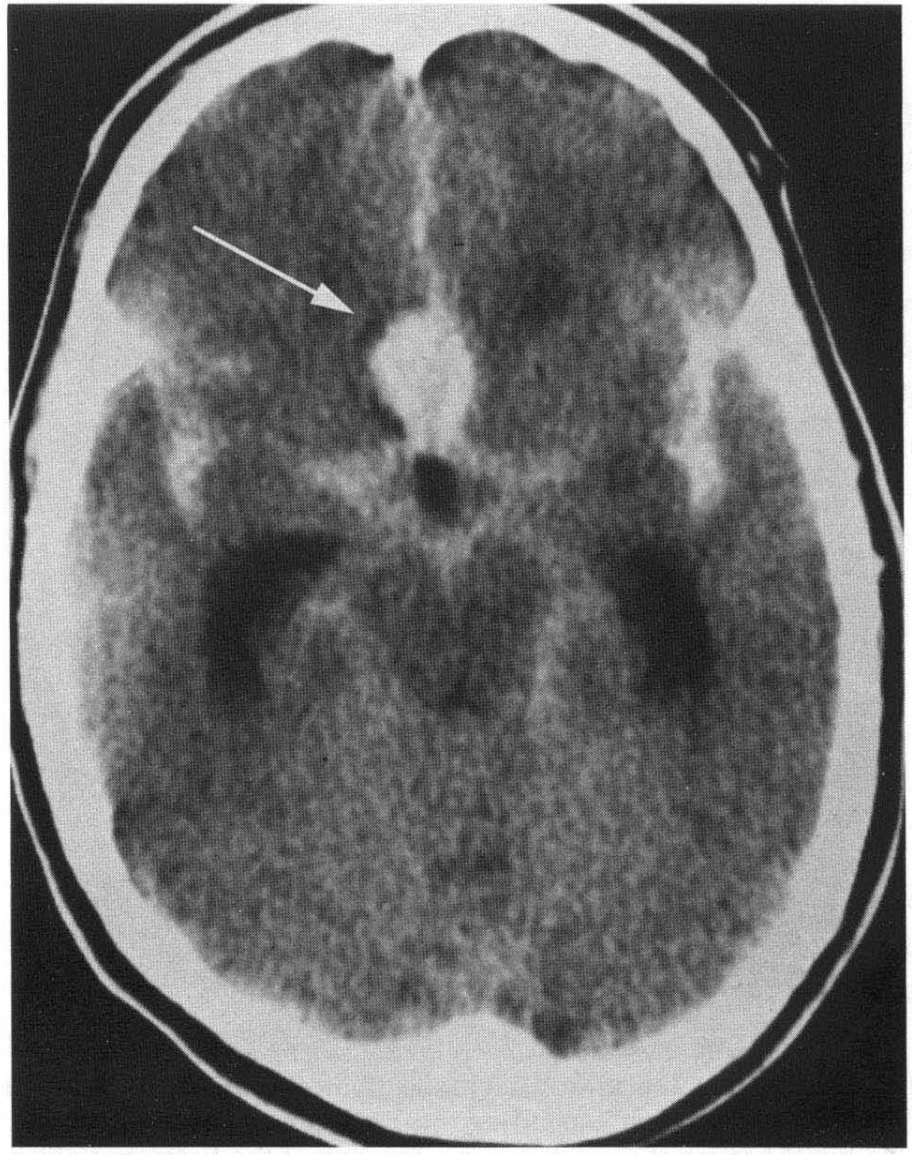


Cisterns on Imaging Studies



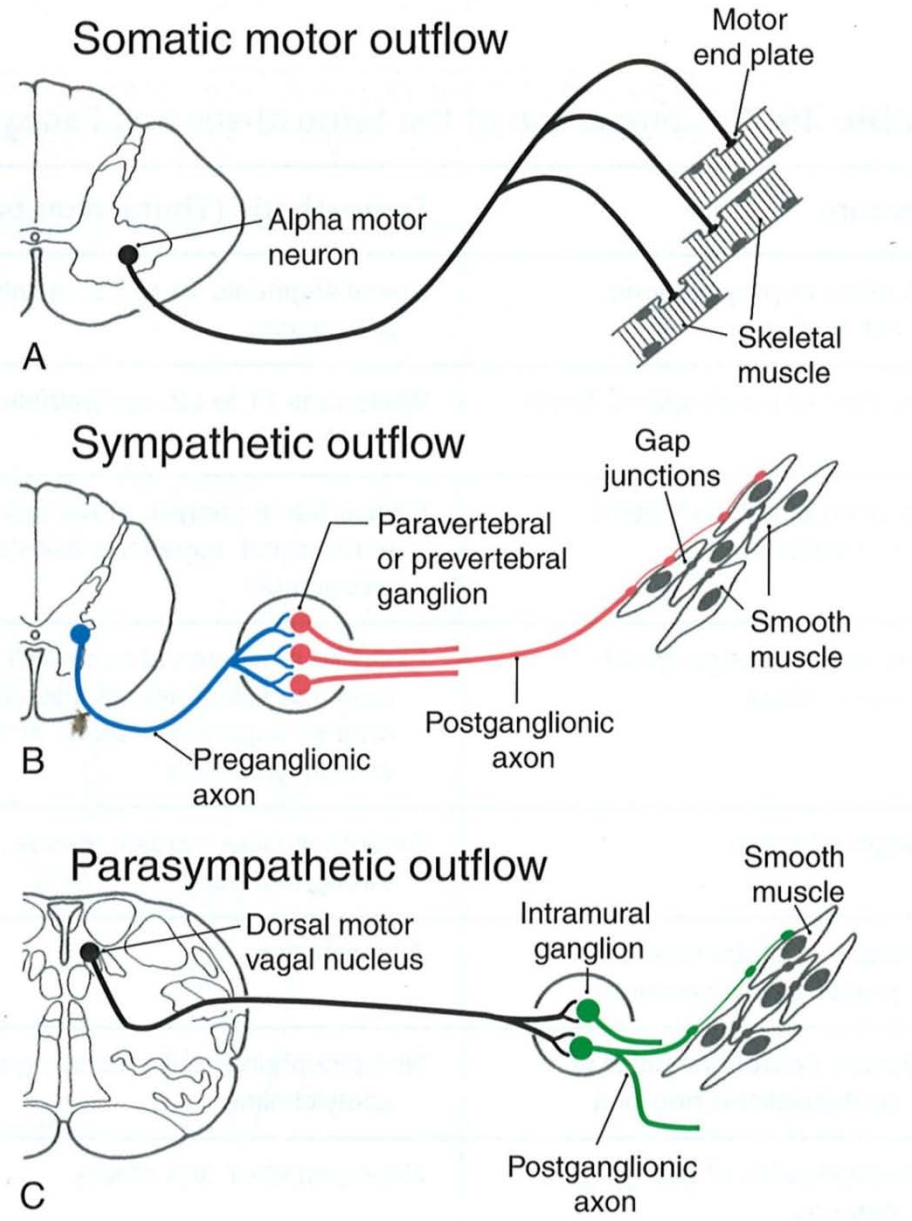
Cisterns on Imaging Studies (bleeding)

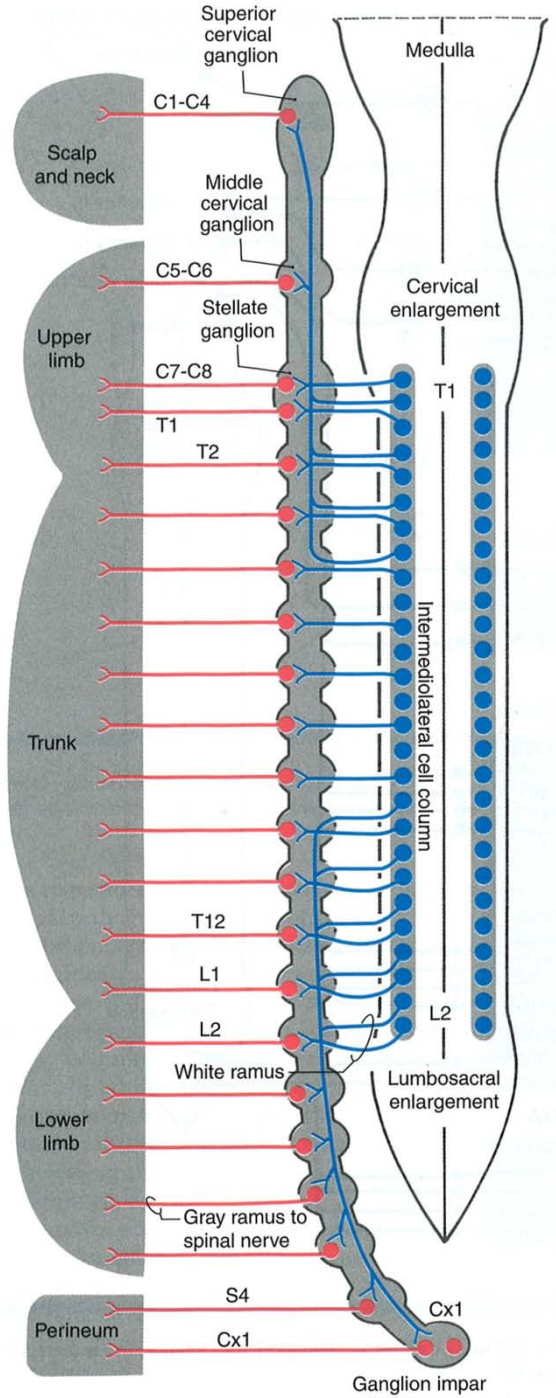




Autonomic Nervous System

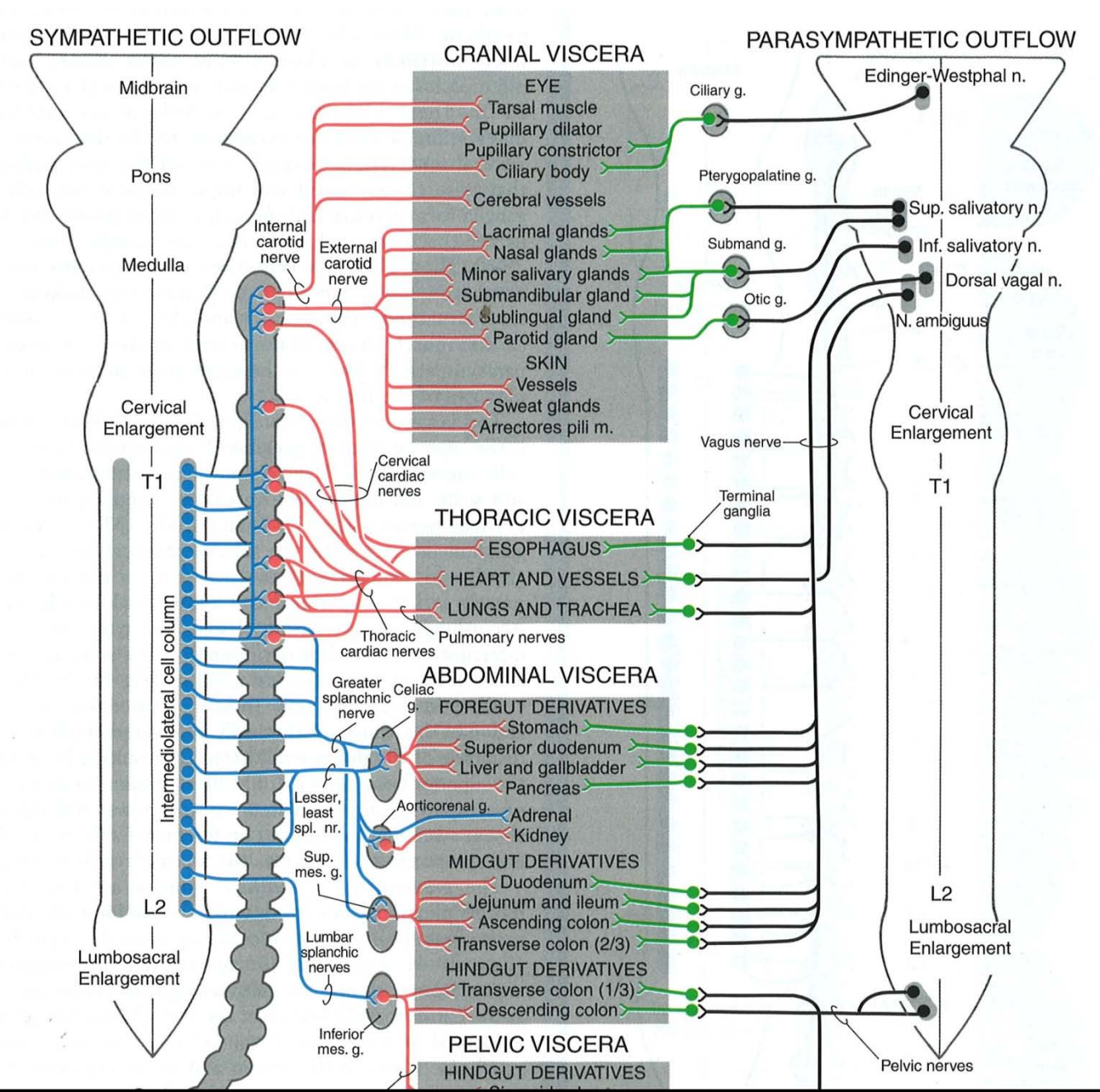
- Pre-ganglionic neurons: CNS
  - Sympathetic: thoracolumbar cord
  - Parasympathetic: brainstem and sacral cord
- Post-ganglionic nerves
  - Sympathetic nerves > parasympathetic nerves
- Transmitters
  - Ganglia: acetylcholine (Ach)
  - Sympathetic: norepinephrine/epinephrine, (sweat glands: Ach)
  - Parasympathetic: Ach





Sympathetic division

- Pre-ganglionic neurons
  - Intermediate cell column (lateral horn)
  - T1-L2/3 (**Thoracolumbar**)
- Sympathetic ganglia neurons
  - Superior cervical ganglia(SCG, C2-3 via internal carotid artery), Middle cervical ganglia, and Stellate ganglia (Inferior cervical ganglia + T1)
  - Sympathetic trunk, Paravertebral ganglia, Prevertebral ganglia

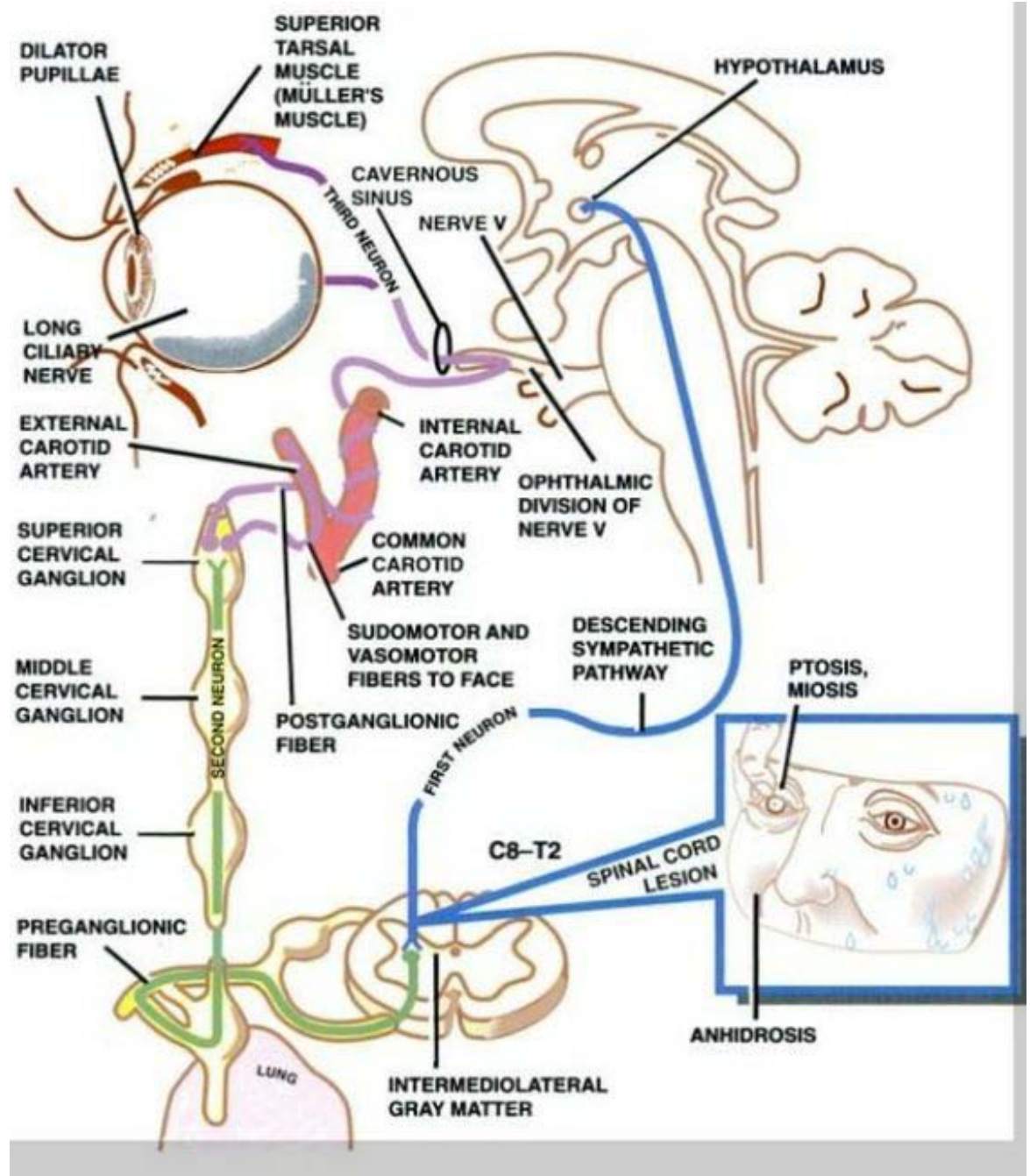


Parasympathetic division

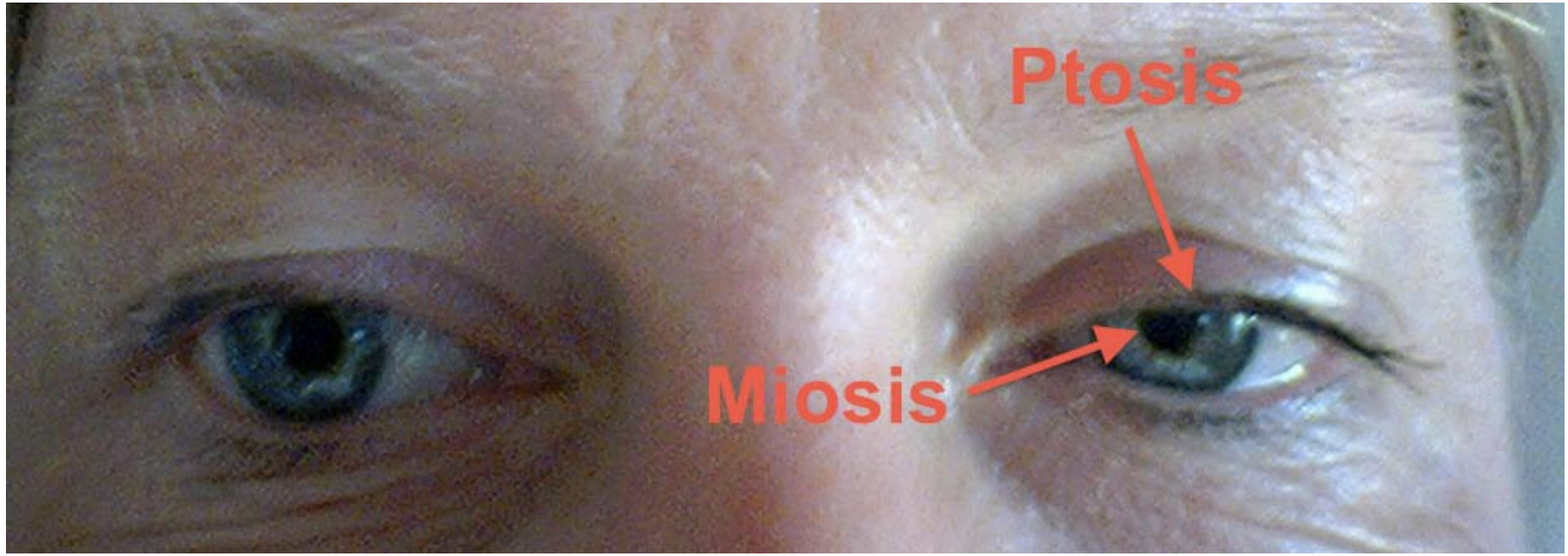
- **Cranial** parasympathetic nuclei in brainstem via
  - Cranial nerve: 3,7,9,10
- **Sacral** parasympathetic nuclei in gray mater of spinal cord (S2-4)
  - ventral roots of S2-4, ventral rami, pelvic splanchnic nerves

Horner syndrome

- injury to the sympathetic system
- Pupil (dilator muscle)
- Eyelid (superior tarsal muscle)
- Face (sweat glands)



Horner syndrome



- signs/symptoms: same side as the lesion of the sympathetic trunk
  - Miosis (x dilator muscles)
  - Partial ptosis (x superior tarsal muscle)
  - Anhidrosis

Organization of CNS

- Cerebral hemisphere
  - Gray matter
    - Cortex: Frontal, Parietal, Occipital, Temporal
      - Hippocampus, Amygdala
    - Deep gray matter: Thalamus, Basal ganglia
- Cerebrospinal fluid and circulation
- Meninges and dural reflections
  - Herniation: relationship to brainstem
- Cerebral blood vessels
- Autonomic Nervous System
  - organization and target tissues/organs